American Machinist
JULY 15, 1936

New York Central Railroad

Eastman's railroad repair shop modernization report stirs up lively comment among executives, some of whom say—

HELP

of Toolbuilders is Needed by Railroads

RAILROADS could learn a great deal from closer cooperation with machine tool manufacturers, important operating and mechanical executives of a number of leading lines told *American Machinist* last week following the issuance of Joseph B. Eastman's report on modernizing railroad repair facilities, published just before he relinquished his post as federal coordinator of transportation.

Eastman estimates an annual saving of $20,000,000 to the railroads through buying enough new machine tools and repair equipment to reduce the average age of this machinery to about eight years from the present average of 21.8. That 87 per cent of the cost of new equipment could be made from savings in reduced upkeep of the machines themselves is striking proof of the high cost of obsolescence, he states.

Many new techniques of metal-working, developed by the machine tool industry for mass production manufacturing, have not yet been widely adopted by the railroad managements, some executives admitted. In the railroad business "the blacksmith type of mind has not yet given in completely to the 0.001-in. viewpoint," one of them confided. He then commented upon the need for closer tolerances and limits of wear demanded today by higher speeds, longer runs and heavier loads.

If the experience of another railroad man is common, some of the blame for lack of genuine cooperation may be laid at the door of machine tool sales representatives. He has found considerable knocking of the other fellow's line by salesmen—which, as he expresses it, puts up a pretty effective barrier against sales of any new machinery. A good chance to demonstrate to railroad mechanical executives the ability of tool builders to help solve an industry's problems is at hand.

Further consolidation of railroad repair shops cannot be expected to bring about any material economies, most of the men interviewed agreed, supporting, in this respect, conclusions made in the Eastman report. During the past decade many such consolidations have taken place. In most instances the best machinery of abandoned shops was shipped to those points where more efficient work could take place.

Discussing the broader implications

Bachrach

"COORDINATOR EASTMAN'S analysis and report of the condition of railroad repair shop equipment and the costs of repairs is a clear exposition of the wastefulness of running obsolete rolling stock and attempting to maintain it with old equipment. The study points to tremendous savings that may be accomplished by replacement.

"MOREOVER, it tells another story to those who experienced the worries and difficulties of transporting vital materials and supplies during the War. Any program of preparedness must contemplate the carrying of huge quantities of materials; to do so efficiently the railroads need an adequate number of locomotives and cars in good running order. Repair facilities including shops and machinery must be held at top efficiency to keep locomotives and cars well conditioned under heavy service. This cannot be done with machinery thirty, forty and fifty years old such as observers have found in use in railroad repair shops.

"THE REPORT shows an average age for all shop machinery of almost twenty-two years. Only the ingenuity of the men in the shops has enabled much of this obsolete equipment to be of any use in repair work. However, even the highest ingenuity of skilled workmen cannot accomplish the close fits that guarantee longer life of serviced parts. The new standards in speed and loads of railroad operation bring precision and balance requirements that can be produced only on modern machines built for the purpose. And only the modern machines can meet the low operating costs demanded of all industries.

"IN THE EVENT of an emergency calling for quick transportation of a vast amount of goods by rail the present shop facilities would be woefully inadequate to hold up their end of the increased maintenance load, and the report shows there now exists a great excess of deferred repairs. The burden would immediately fall upon the machine tool industry and the railroad requirements for new machinery added to the known needs of the Army, the Navy, and the needs of essential industries would be such that the machine tool plants would be completely overwhelmed.

"MODERNIZATION of railroad shops should go forward at the earliest possible moment. The railroads would gain the advantage of immediate and large savings in the operation of their business. It is essential to the nation's defense position that this be done."

—HERMAN H. LIND

General Manager
National Machine Tool Builders' Association

of consolidation of repair shops one of the country's most important railroad executives branded as "ruthless" some past shop mergers which doomed to a lingering death small communities which had grown to depend upon the local railroad shops as the nucleus of their economic life. "The balance sheet alone does not give the whole picture of industry," this executive says, "and we must take responsibility for the social as well as the economic changes our decisions bring about."

The Eastman report deals with railroad shops but it applies with equal force to many other shops in this country. Railroad shops have no monopoly on bad equipment, nor on economic misfortune. For that reason men in other shops will find in it plenty of food for thought. If they will mentally substitute the name of the product they make for the word "locomotive" in what follows they will get a better idea of its significance.

Main points in the Eastman report are:

1. The average age of machine tools in railroad repair shops is 21.8 years, and much of it is inadequate to meet today's demands for higher accuracy in fits and tolerances.

2. About 27 per cent of the total railroad operating expense is represented by maintenance of equipment.

3. Locomotive repairs alone amount to $400,000,000 per year.

4. Once every 4.29 years an amount equal to the original cost of all locomotives is spent for repairs on these engines.

5. Of all net expenditures made for additions and betterments to roadway and equipment during the 17½-year period ended December 31, 1931, only 1.23 per cent was for improving shop machinery, and 2.71 per cent for improving shops and engine houses.

6. Lack of suitable repair facilities is costly, because it is keeping too large a percentage of locomotives and cars in the shops and on sidings waiting their turn for repairs and overhauls.

The Eastman report not only discusses rehabilitation of existing repair shops, construction of new facilities and installing modern machinery, but also urges revised management policies in setting standards of performance of repaired units. The importance of better schedules for repairing and methods for maintaining locomotives and cars is stressed.

The report tells how one railroad reduced its operating ratio over a period of ten years from 77 to 55 per cent and cut its fuel consumption by about 50 per cent. Another line, by following a similar plan of carrying out a modernization program in its shops, reduced its operating ratio from 76 to 56 per cent during the same period. Obviously, all lines cannot be expected to perform such savings, but the achievement of these roads indicate that there are savings worth striving for.

Although the report says that little savings can be achieved by mere consolidation of repair shops, certainly no broad modernization should be undertaken without considering the possibilities of eliminating little-used repair pits and minor shops and shipping the usable equipment to those points where more efficient work can be done.

The importance of keeping as many locomotives and cars as possible in service at all times is emphasized in the report. Of the 49,215 locomotives available for service as of October 1, 1933, 10,879, or 22 per cent, were either undergoing or awaiting repairs. A large part of this high percentage of layover of locomotives is chargeable directly to the inadequacy of repair shop facilities.

As bad as is the condition in locomotive repair shops, the situation in respect to roundhouses, where minor repairs are made, is even worse, the report shows. Whereas about 40,000 engines are handled per day in all the roundhouses in the country, improved facilities would take care of about 100,000 per day (24 hours) which would eliminate an idle investment in locomotives amounting to $139,152,732. By equipping car shops with new machinery and adopting "straight-line production" methods of handling cars, an idle investment of $19,241,376 would be eliminated in "heavy" repairs alone. Speedier handling of cars subject to "light" repairs would eliminate another idle investment item of considerable size, although the report found it diffi-

cult to estimate the exact amount.

"Shop machinery is the most important factor in a complete set-up of locomotive and car repair facilities," the report says. The Class I railways own $320,493,901 worth of this machinery, and pay $23,700,000 a year for machinery repairs, or an annual maintenance charge amounting to 7.4 per cent of the investment.

Few shops manufacture parts on a sizeable scale. In repairing, however, few machines over 14 years old can compare with new ones of the same make, and there are many cases where new methods have been devised that are much more efficient than the old. Grinding machines are an example of this. Guide bars and similar parts can be finished more efficiently by grinding than by the older methods. Piston rods can be ground without removing the piston. Some shops are grinding crank pins and axles instead of rolling them, as was the old practice.

Another reason for high maintenance costs, as has been pointed out before in *American Machinist*, is the lack of standardization. Constant change in design of locomotives adds much more to the cost of maintenance than to the efficiency of transportation. To gain a slight increased efficiency, some railroad executives have bought locomotives without counting the huge cost of stocking parts for these non-standard units. The larger the number of locomotive types in use, the greater must be the investment in parts and special tools. This, and the cost of storing additional parts quickly absorbs any real gain the locomotives may have in tractive power or in fuel economy. If all freak locomotives were scrapped it would save a great deal in maintenance and provide funds for new equipment. On the other hand, progress requires change and experimentation, costly as it is. More and more standardization work is being undertaken by the mechanical division of the Association of American Railroads, which already has a mass of information developed on every phase of the industry's mechanical problems.

Standards establishing limits of wear, tolerances, quality of materials used for maintenance and standards of performance of equipment are needed, the report says, pointing out that there is no uniformity either in respect to these factors or of policy of management, organization of mechanical departments, shop organization, design of equipment and detail parts.

Although repair shop practices and production manufacturing problems are fundamentally different in respect to tolerances required, scheduling, plant layout and other factors, several railroad executives interviewed by *American Machinist* indicated that there is much to be learned from closer cooperation with machine tool builders. New metal-working techniques, developed in mass production manufacturing, have many elements which might well be adopted by locomotive and car repair shops. The relatively simple expediency of "straight-line" production has been adopted with notable success by one of the larger systems of the country with a marked reduction in cost and increase in speed and accuracy. Each man, according to a high executive of the railroad, performs a given task as the unit comes down the line to his "stand" with the result that he becomes expert at this particular job.

Time was, on the other hand, when locomotive engineers had their "own" locomotives. When the engineer was resting after his run the locomotive was in the roundhouse, resting too. Division points have been extended on most lines, and the same engine will run through with successive shifts of crew. This, simply one of the many indications of change, shows that operating conditions in the railroad business need careful study by machine tool makers if they are to best serve this huge, basic industry. Just as the engineer's name plate on the cab of "his" locomotive was a symbol of operation at an earlier stage of railroad history, new machine tools and better repair methods can be made a symbol of today's railroading.

"SPECIFIC INFORMATION as to economies resulting from purchase of modern shop tools and machinery is not available at this time, but our experience definitely reflects economies from maintaining the most modern types of shop tools and machinery adapted to our requirements, and that on the other hand, efforts to utilize tools and machinery to their full serviceable lives, in disregard of obsolescence due to later developments, is false economy.

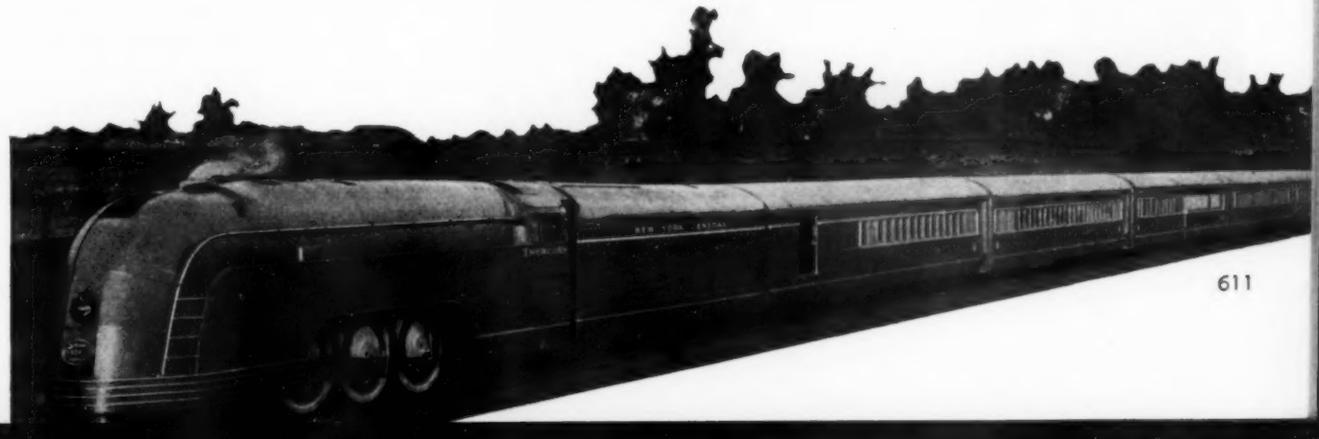
"IT HAS also been found, in connection with development of high speed diesel powered trains and more modern types of rolling stock equipment, that tools and machinery, even though suitable for the older types of equipment, are not adaptable to the new service required without loss of efficiency.

"THE EFFECTS of greater precision in shop work are reflected in improved operating performance and reduced cost of maintenance of equipment, and we expect the requirements for precision workmanship to increase as research becomes more aggressive."

Wide World

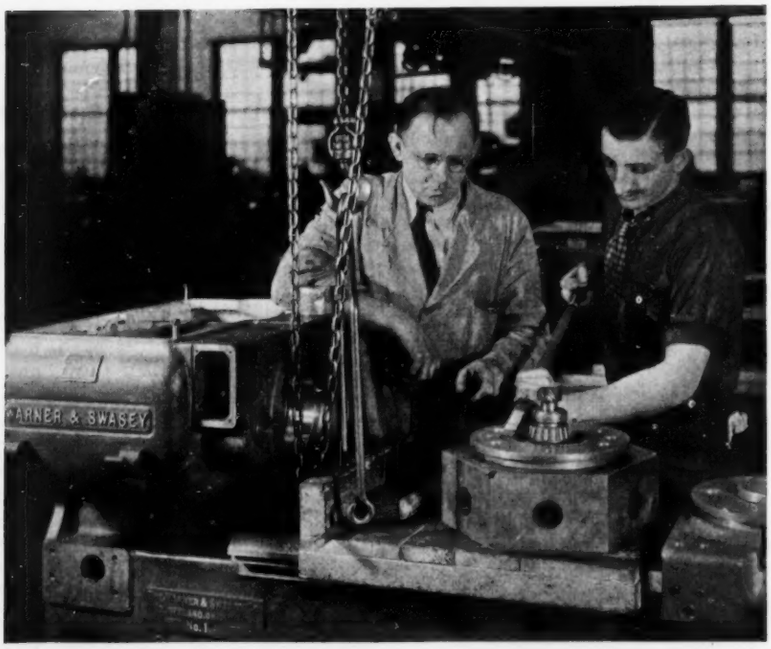
—C. R. GRAY
President
Union Pacific Railroad Company

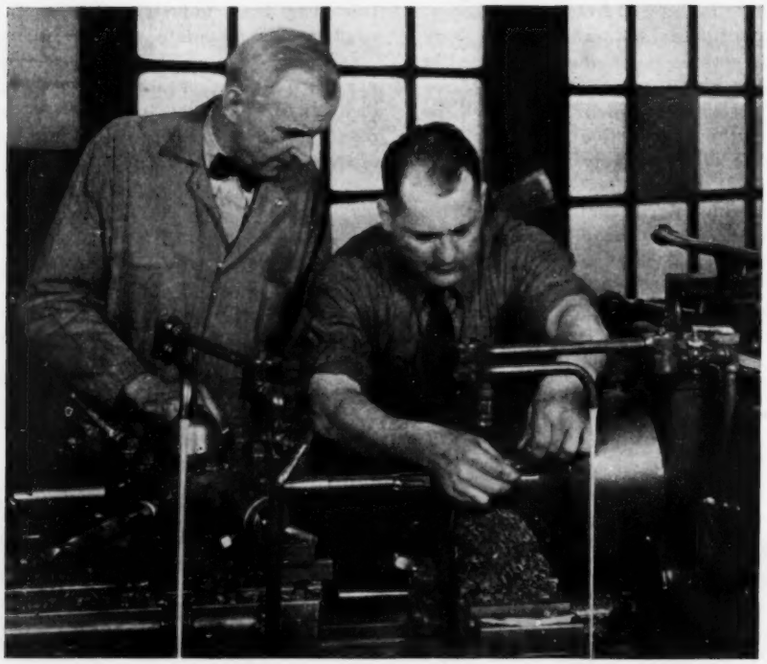
New York Central's high speed "Mercury" train has just begun daily runs between Cleveland and Detroit, via Toledo, after touring the system for public inspection



LEARNERS, SPECIAL LEARNERS, APPRENTICES

WARNER SEELEY
Secretary,
The Warner & Swasey Company





WHEN activity in the machine tool industry returned, the demand for skilled workers rapidly overtook the supply. Soon thereafter it became obvious in most manufacturing centers that highly skilled workers in the metal trades were no longer available, and that a rapid return on the part of employers to the business of training men must be undertaken if the shortage was to be met adequately. Unfortunately, there is not even yet sufficient activity in the development of men, to take their places as skilled workers, to keep up with the needs of the metal working industry. It is hoped that this article, which describes the plans undertaken recently by one manufacturer, will indicate to all how easy it is to get a training program under way and how effective it can be if adequately conceived and carefully administered.

Many former employees did not answer the call back to work. Some had left town and their new addresses were unknown. Others had found jobs in other fields and, naturally, were unwilling to give up a sure thing, even though it might not be so remunerative or congenial, for work of uncertain duration. Because skill is frequently the result of years of experience, it was only natural that during the past four or five years, many men who would have been called back had died. Finally, several years of idleness with its mental strain frequently combined with the development in machine tools themselves to turn a man from a first class workman into one of only ordinary ability.

The company had to think and plan fast to meet the deficiency as quickly as possible.

Above—*Scraping is taught on the job by an expert.* Left—*A "learner" learns how to operate a turret lathe and "mike" his work*

Warner & Swasey's training plan encompasses both immediate and future needs for men and takes care of men and boys with or without education

A three-way program designed to take care both of immediate necessities and long range needs was worked out. It includes groups of men who are known respectively as learners, special learners and apprentices.

Learners are men who have had some experience in or a decided aptitude for machine tool operation. They are generally men of mature years, who had perhaps had occasion to do machine work before or during the depression. Ideally, they are men ranging in age from 24 to 35 years.

Learners are put on one type of machine tool and kept there until they prove themselves or are found to be hopeless. Normally no attempt is made to give them all-round experience, especially in view of the fact that the work on any one machine in the Warner & Swasey plant is of a varied type. This in itself tends to develop skill at a comparatively rapid rate. There are some exceptions, however, in the cases of men who may be transferred from one department to another, if they display a particular aptitude.

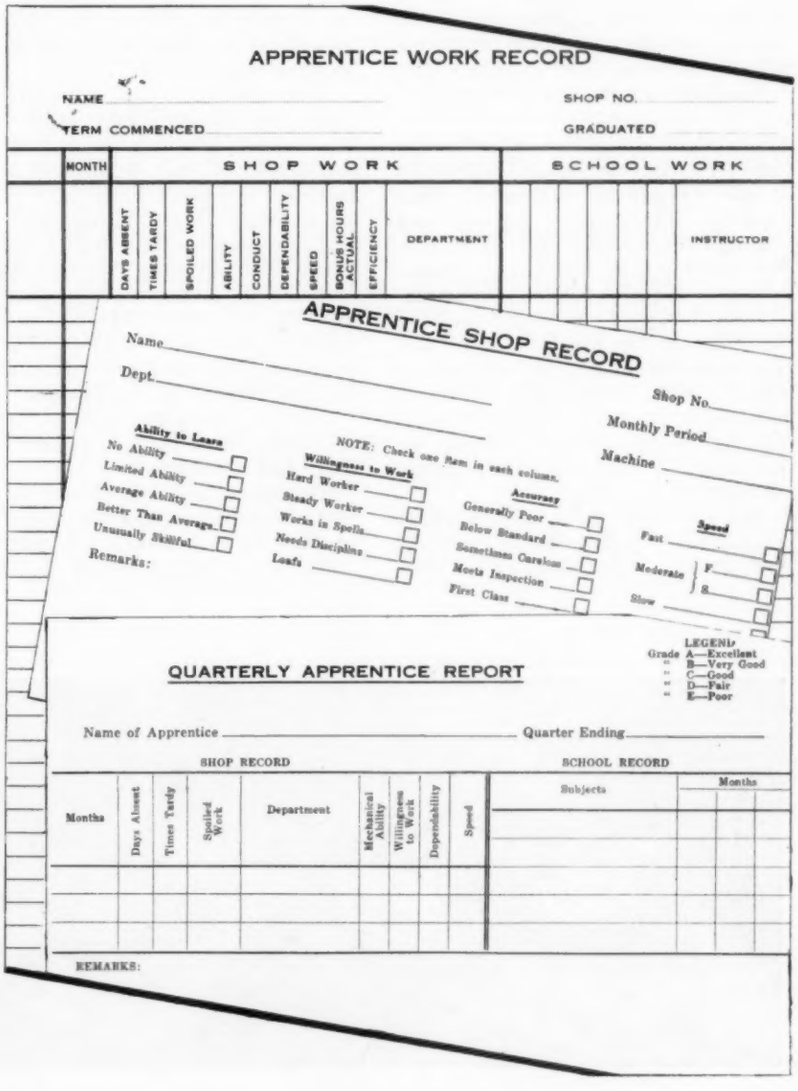
Foremen, the key men in all production, must be relied upon for full cooperation in the training of learners. Each foreman in whose department learners are being trained has designated one or more of his most skilled journeymen as set-up men and straw bosses for the group of learners in his department. The average foreman, with his full departmental responsibilities, cannot successfully train a group of learners without assistance, so the set-up men have been given the task which amounts to that of assistant foreman or instructor. They, of course, realize that the learners are underexperienced and for that reason require a great amount of extra patience and watchful guiding. It is because of this understanding on the part of the foremen that the turnover of learners has been so gratifying low.

Learners are started at 50 cents an hour and advanced just as rapidly as their increasing skill permits. Occasionally, they go from the starting rate to the skilled rate in a week.

The system was started in May, 1935, and up to June 1 of this year, 88 learners were placed on the pay roll. Of these, 37 per cent were given increases very soon after they started to work; 20 per cent are rated as skilled workmen and receive the top scale; 20 per cent have been discharged; seven per cent have quit and the balance are still classed as learners but continue to show promise. The help and training we provide is making a supply of skilled help which would otherwise have continued in the common labor classification. We have bridged the immediate shortage of skilled labor and have been able to keep the plant working for two and three shifts a day and at the same time keep our production schedule and quality at a high point.

This is especially true because we religiously avoid men who are merely looking for a job and who will leave as soon as something more attractive shows up. In addition, we urge learners to take courses in night schools. There is no compulsion in this nor do we check up to see which ones are going to school, but the rapid progress that some of them have made leads us to believe that many are taking this advice.

The next group through which we are meeting present problems is desig-



APPRENTICE WORK RECORD

NAME _____ SHOP NO. _____

TERM COMMENCED _____ GRADUATED _____

MONTH	SHOP WORK									SCHOOL WORK	
	DAYS ABSENT	TIMES TARDY	SPOILED WORK	ABILITY	CONDUCT	DEPENDABILITY	SPEED	BONUS HOURS ACTUAL	EFFICIENCY	DEPARTMENT	INSTRUCTOR

APPRENTICE SHOP RECORD

Name _____ Shop No. _____

Dept. _____ Monthly Period _____

Machine _____

NOTE: Check one item in each column.

Ability to Learn: No Ability ☐ Limited Ability ☐ Average Ability ☐ Better Than Average ☐ Unusually Skillful ☐

Remarks:

Willingness to Work: Hard Worker ☐ Steady Worker ☐ Works in Spells ☐ Needs Discipline ☐ Loafs ☐

Accuracy: Generally Poor ☐ Below Standard ☐ Sometimes Careless ☐ Meets Inspection ☐ First Class ☐

Speed: Fast ☐ Moderate ☐ F ☐ S ☐ Slow ☐

QUARTERLY APPRENTICE REPORT

LEGEND
Grade A—Excellent
" B—Very Good
" C—Good
" D—Fair
" E—Poor

Name of Apprentice _____ Quarter Ending _____

SHOP RECORD									SCHOOL RECORD	
Months	Days Absent	Times Tardy	Spoiled Work	Department	Mechanical Ability	Willingness to Work	Dependability	Speed	Subjects	Months

REMARKS:

nated as special learners. These are graduates from technical schools and colleges who are not averse to wearing overalls and getting their hands dirty while learning the machine tool business from the bottom.

They are placed in one department after another, getting a well rounded experience. This, added to their technical college training and knowledge, should, we feel, make them eligible for "white collar" jobs, although no promises whatsoever are made when they come to work.

If they have aptitude and interest in machine tool building, it is only natural that after a probationary period many of these young men should be considered for positions in the field leading eventually to the sales force, in the drafting and estimating departments, or as supervisors and executives in the plant.

We are frank to confess that our experience to date with special learners is not of sufficient duration to allow us to form accurate judgment as to the results we shall get. However, the idea seems sound and to posses very considerable possibilities, so we are giving it a serious trial.

Our third group of men in training are those in our regular apprentice course. Begun more than 50 years ago, this training course has continued vigorously ever since with only three interruptions, the last being brought about by the near collapse of the machinery industry. By again building up our apprentice numbers, we are preparing for the long range skill and for the key men and all-round machinists who are now and will be needed by industry. Because of the depression we shall have no apprentice graduates until 1939.

Our apprentices must be high school graduates, preferably from technical high schools. They cannot be less than 17 nor more than 19 years old and must have marked mechanical ability.

Before they are hired, they are interviewed several times. We talk to their parents, check their school records and get the impressions of their teachers. In spite of this rigorous routine, we have an extensive waiting list from which future apprentices will naturally be chosen.

Class Room Work

When they are hired, they start a four-year course with a half-day of class room instruction each week. This is given in a trade school under the supervision of the Cleveland Board of Education. The curriculum was carefully worked out jointly by representatives of our employment department and of the teaching staff of the schools.

In the class room they are trained in mechanical drawing, trigonometry, shop mathematics and shop practice. In the plant they are given a complete training in every department, those showing special talent getting some time in the drawing room as well.

Apprentices are not segregated in their shop training. Each department has its quota of boys in training. These are transferred from department to department in accordance with the schedule controlled by the employment manager. A specimen of this schedule is illustrated. An apprentice superviser whose sole activity is that of apprentice instruction and coordination makes daily visits to each boy. His instruction is augmented by that of the department foreman who issues the jobs and provides such instruction as is of special importance from the standpoint of the individual department.

The apprentice starting rate is 27½ cents an hour and increases are given of 2½ cents an hour every six months.

Apprentice ratings reflect the combined judgment of the department foreman and the apprentice instructor. These ratings are made monthly and once each quarter reports are condensed and submitted to parents to indicate the progress of the boy. It has been our experience that the more flexible the boy's schedule is, the more opportunities can be made available to him for special instruction. For example, whenever it is possible to rearrange a boy's schedule to include training in an extra department, such as the drawing room or tool design, this is done, and the general result is that the boy definitely responds to such opportunities. In this respect the procedure for the routing of apprentices is not materially different from our practice before the depression. If anything, the plan is more flexible, rather than less.

The proof of the pudding is found in the high percentage of graduate apprentices among our leaders. These include branch managers, a long list of salesmen, machine demonstrators, foremen, assistant foremen, and inspectors, as well as many now in the office.

With these three methods of training, we believe we can solve our problems of supply of skilled men in a highly satisfactory way and can assure ourselves not only of the requisite skill, but of enthusiastic and effective material for every department. The great need throughout the metal-working field is for definite training programs to be undertaken by large numbers of employers. We have proved to ourselves that our three groups, described in this article, are not only not burdensome, but are producing the kind and the quantity of skill that we need. It is our hope that many others will be prompted to undertake training programs of their own in order that the entire field may not have to suffer longer from the tendency of the past of letting the other fellow do it.

Class room instruction under the direction of the Cleveland Board of Education

HIDE and SEEK STYLING

A PLANT ENGINEER

AFTER SPENDING several days at the Machine Tool Show last September and reading the industrial papers on the latest developments in machine tools, I began to wonder whether some manufacturers had missed the point altogether on "styling." Does the designer realize that he is designing machine tools and not furniture? Has he forgotten all about the maintenance man in the shop who has to service his design and who many times wishes he had the designer present to make him crawl around on his belly to get at some motor or gadget that styling or an attempt at styling has decreed shall be concealed.

Styling has a place in the machine tool industry. The display of antiques on the stage of the show clearly demonstrated that the early designers had a desire to incorporate a pleasing appearance into the design of their products. The curves and scrolls and other decorative features indicate this.

Function First

Today we should still have that desire. Our machines should present an attractive appearance, but function should still be the primary purpose, service secondary and lastly appearance.

To improve the appearance of a machine we may call in a stylist, and when we are through our grinder may look like your wife's new gas stove or kitchen sink. What we should strive to do is not to style our machine but to give it a "clean" appearance.

There are many ways to do this. Use socket head fillister screws in place of hex head screws. Fill up all the pockets and places that are dirt catchers. Cover up some of the mechanisms with smooth covers. Put some of the ribbing on the inside where possible. Some bosses can very well project to the inside leaving a smooth surface on the outside. Many minor changes like that can be made that have a decided effect on the appearance of the machine.

A "clean" machine will encourage the operator to keep it clean. A machine should be easy to wipe off without skinning his knuckles. Grooves running around the base like the stripes on a jail-bird's uniform do not help improve the appearance but afford a place for the dirt to gather. Grooves or beads running up the back of a column and around a head do not encourage an operator to wipe it off as frequently as he would if it were all smooth.

Probably for some manufacturers the style pendulum has swung way over, and they have gone to extremes in styling. Here is a paragraph that appeared in a recent article describing a machine pictured: "Here, as elsewhere is the same line, decorative lines have not been haphazardly placed, but to emphasize functions. When the part moves the lines parallel the line of motion." Does that indicate that we will soon have to provide streamlined operators whose movements will harmonize with the movements of the decorative lines of the machines? One manufacturer, not so long ago, announced a "streamlined" electric drill. Evidently the operators were being fatigued by the air resistance of the old style drill, and the manufacturer was offering relief for this condition in this new design.

A little item that appeared in a current magazine said that the advantage our modernistic houses have is that when you tire of them you can very readily convert them into a gas station. And so with some of our modernistic machine tools—you may be able to convert them into kitchen sinks or bathtubs.

Let's get another word when referring to machine tools that will designate "clean" design without sacrificing function and service and leave the word "styling" for the furniture, appliance, fixture and kindred lines of apparatus.

When it comes to servicing some of our modern machine tools of the "hide-and-seek" design (the designer hides it and the repair man seeks it), many a designer has been roundly cussed by the shop maintenance man who has been forced to squeeze and squirm, crawl and twist when delving into the inwards of some of the modern creations. Unfortunately, things do go wrong with machines, and the repair man must get them straightened out in the shortest time. Motors do fail sometimes and what a picnic it is to get some of them out. No room for a wrench. Besides that there may be a few pipes and shafts and levers that make it all so decidedly unpleasant. You have to be a contortionist to get at it or have three hands with fingers about ten inches long.

Where's the Motor?

What electrician wants to take half of the machine apart to remove a faulty motor or controller? And what a pleasant sight greets his eyes when he examines his motors on a machine where they are hidden away with the hydraulic system and the coolant pump and tank, all in the same space, and how they love to mingle together. Motors covered with oil and dirt, windings saturated and soggy—just a lovely mess.

This is not the situation on all recent designs. You may recall some of the machines you saw at the show or read about in the *American Machinist*. The motor is accessible and yet harmonizes with the design of the machine, probably a flange-mounted motor. The controls are concealed, yet by opening a large door you can conveniently service them. Other mechanisms can be reached conveniently by removing a cover.

Sometimes it is well to sacrifice the "girlish figure" of your design and provide a few bulges in order to favor the maintenance man. The man in the "front office" of your customer's plant may prefer your design, but its ultimate success in that shop depends largely upon the opinion of the men in the shop —the foreman, the operator and the maintenance man. Give them sufficient consideration in your design.

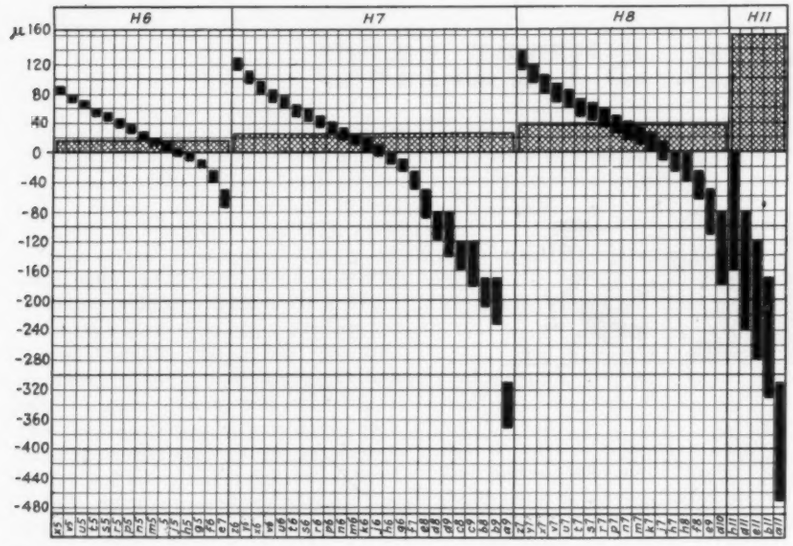


Fig. 1—Hole limits are cross hatched and shaft limits are shown in black in this selection of ISA fits suggested for use in the machine industry

ISA FITS

Sixteen countries have accepted as standard the system of cylindrical tolerances recently completed by the International Standards Association

JOHN GAILLARD

Mechanical Engineer, American Standards Association

A STANDARD SYSTEM of fits between cylindrical parts, intended to bring about international uniformity, has been completed for nominal sizes up to 500 mm. (about 20 in). It has been developed by a technical committee of the International Standards Association (ISA)—a federation of national standardizing bodies in twenty countries, including the American Standards Association (ASA). A tentative draft of the ISA system applying to normal sizes up to 180 mm. (about 7 in.) was described in an earlier article (*AM*—Vol. 78, page 403).

Sixteen countries have already approved the ISA system as follows: Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Holland, Hungary, Italy, Japan, Norway, Poland, Sweden, Switzerland and U.S.S.R. Its adoption as a national standard in the U. S. and Great Britain would bring about world-wide unification of cylindrical fits.

The ASA committee on "Allowances and Tolerances for Cylindrical Parts and Limit Gages" is considering a revision of the American tentative standard for fits (B4a) adopted in 1925. It intends making a canvass of several branches of industry to find out, among other things, whether the ISA system is deemed suitable for use in this country.

The extension of the system to nominal sizes up to 1,600 mm. (about 63 in.) is under way. For this larger range, formulas have been proposed to enable the designer to calculate the limits of the mating parts for different kinds of fits.

Brief History

The ISA system is the result of almost ten years' work by an ISA subcommittee of technical experts representing Germany. France, Sweden, Switzerland and Czechoslovakia. In building the system, the highest possible degree of interchangeability was aimed at in regard to fits given in the national standard systems existing when the ISA work was started (1926). Ten years ago the most important national standards were the American, British, German, Swedish and Swiss. Although neither American nor British industry has taken an active part in the development of the ISA system, Great Britain decided a few years ago to change its national standard reference temperature for gages from 62 to 68 F (standard also in the U. S.) for the sake of international uniformity, thus adapting one of the essential features of the ISA system.

The ISA committee agreed that limits for fits must be based on practical experience—not on theory. Formulas for tolerances and allowances, used as a framework, represent the experience gathered in workshop practice. A special study was made of wide clearance fits and very tight press fits before they were finally adopted. A few of the latter are still tentative, but as a whole, the recommendations for the range up to 20 in. have reached their final shape.

Each American manufacturer will be able to decide whether the ISA system contains the fits required for his work—the main question in finding out whether the system is suitable to replace the American standard of 1925. Whether the product involved is machine tools, automobiles, electric motors, telephone equipment, railway cars, agri-

FIND FAVOR

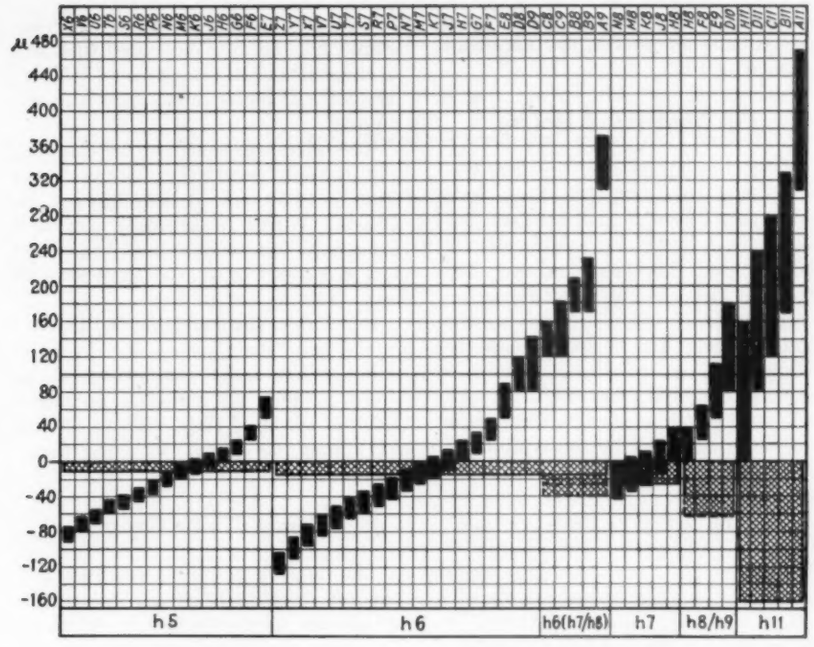


Fig. 2—Shaft limits are cross hatched and hole limits are shown in black in this selection of ISA fits using the basic shaft system

cultural machinery or any other in which fits play a rôle, the revision of our national standard should be given due attention because of its great technical and economic significance.

1. The *reference temperature* for limit gages is 20 C (68 F). This means that a gage must have its nominal size (equal to the limit of the work which it is intended to check) when the gage is at the temperature of 68 F. France and Great Britain have given up their previous national standard reference temperatures of zero C (32 F) and 62 F, respectively, for the sake of international uniformity. The reference temperature of 68 F is also specified in the American standard of 1925. World-wide uniformity in this respect has thus been reached, with obvious benefit to gage makers and users. Until a few years ago, American gage manufacturers, in carrying out foreign orders, had to deal with three different reference temperatures (32, 62 and 68 F) and, incidentally, with different in.-mm. conversion ratios. The latter difficulty has been removed by the adoption of the ratio 25.4 by the industries in Great Britain and the U.S. (American Standard Inch-Millimeter Conversion for Industrial Use, B48.1-1933), which paved the way for the recommendation of its general international adoption by the ISA.

2. The nominal size line of the mating parts serves as the reference line from which the limits of workpieces and gages are located. This principle was followed also in the national standards existing prior to the ISA system, including the American standard of 1925.

3. The ISA system gives fits in the basic hole, as well as in the basic shaft system. In the basic hole system, a few holes whose low limit is the nominal size, are mated with a larger number of shafts whose limits are varied to produce the different fits. In a basic shaft system, a few shafts, with the nominal size as their high limit, are mated with a series of holes whose limits are chosen so as to get various fits.

Most of the national standards existing in 1926 gave fits in both systems, basic hole and basic shaft. The American standard of 1925 gives the basic hole system exclusively and has been criticized on this score. For example, industries able to get satisfactory fits with cold-finished shafting, without machining it, are interested in a basic shaft system. The ASA committee on fits has agreed in principle that such a system should be added when the 1925 standard is revised.

4. The ISA tolerances are unilateral: the tolerance on a part is measured in one direction from its basic size, and not as a "plus and minus" variation, or bilateral tolerance. The unilateral system had been adopted in all national standards existing in 1926. In addition to the unilateral system, the British Standard of 1924 gives bilateral tolerances because these were originally adopted in the British Standard of 1906. However, the 1924 edition does not recommend bilateral tolerances for new work.

5. The ISA system gives a series of standard shafts and a series of standard holes. These may be mated at will by the designer. The earlier national standards, except the British and the Dutch, gave definite fits (hole-shaft combinations) to serve as a guide. The American standard of 1925 gives eight combinations ranging from a loose fit (Class 1) to a heavy force and shrink fit (Class 8).

With a view to traditional practice, the ISA committee has given recommended ISA fits in the basic hole, and in the basic shaft system.

6. In the ISA system, the manufacturing tolerance on a "go" gage must lie within the limits of the workpiece but the gage may be used until it has worn a definite small amount past the "go" limit of the work. A plus or minus variation is permitted from the nominal size of a "not go" gage. These rules are in accordance with those of the major European stand-

ards existing in 1926, but differ from the principle adopted in the American standard of 1925.

ISA Shafts and Holes

For each nominal size, the ISA system gives a series of shafts. Each shaft is designated by a symbol consisting of a lower case letter and a numeral, for example: *d8*. The letter indicates the minimum clearance of interference between the shaft and a hole having the nominal size. This value equals the distance between the reference line and the shaft limit lying nearest to it. All basic shafts—for which this distance is zero—are designated by the symbol *h*.

The numeral of the shaft symbol indicates the grade of the shaft which depends on the number of tolerance units* of the shaft tolerance. The ISA shafts intended for fits are divided into seven grades, 5 to 11. The corresponding tolerances on a 1-in. shaft range from 9 to 130 microns, or about 3.5 to 51 tenths.

The ISA system also gives a series of standard holes for fits. The symbol of a hole consists of a capital letter followed by a numeral, such as *R7*. Basic holes have the letter *H*. The holes intended for fits are divided into five grades, 6 to 11.

It is easier, and hence less expensive, to keep a shaft between given limits, than a hole. Shafts of the finest grade (5) have tolerances that are 0.7 of those of the finest grade holes (grade 6).

Basic Hole System Primary

The ISA standard shafts were developed first. Their limits approach as closely as is compatible with practical requirements, curves plotted for their tolerances and allowances. The hole tolerances were chosen next, in such a way that the fits available in the basic hole system may also be obtained in the basic shaft system.

The basic hole and the basic shaft system have thus been given equal consideration, but the latter has been adapted to the former. The basic hole system was made the primary system, because it is the one most commonly used.

Recommended ISA Fits

Fig. 1 shows a series of ISA fits in the basic hole system recommended for general use in the mechanical industry. Each of four basic holes (*H6, H7, H8* and *H11*) indicated by double cross-hatched bars, may be mated with any of the corresponding shafts. For example, hole *H6* may be mated with any of the shafts *e7* to *x7*, inclusive. (Note: The scale of limits shown here is in microns.)

The tolerances shown in the diagram, Fig. 1, apply generally to nominal sizes from 30 to 50 mm. (1.18 to 1.97 in.) inclusive. Where this subrange is divided again into two smaller ones, the values in Fig. 1 apply to the subrange 30 to 40 mm. (1.18 to 1.57 in.)

Fig. 2 gives the recommended ISA fits in the basic shaft system for the same nominal size range (or subrange) as given in Fig. 1 (limits in microns). Each of six basic shafts (*h5 to h9* and *h11*) may be mated with the corresponding holes.

Nominal Size Ranges

The range of nominal sizes from 1 to 500 mm. (0.04 to 19.69 in.) inclusive, is subdivided into a number of subranges for each of which the tolerances and allowance remain constant.

The number of subranges is 13, 23 or 25, depending on the kind of holes or shafts. Tight press fits being very sensitive to variation in the interference of metal, the subranges are smaller for shafts *r* to *z*, and holes *R* to *Z*, intended to produce these fits, than for shafts *d* to *p*, and holes *D* to *P*, used for the regular clearance and transition fits. Similarly, for the very loose fits obtained with shafts *a*, *b* and *c*, or holes *A*, *B* and *C*, a finer subdivision of the nominal size range above 30 mm. (1.18 in.) has been adopted with a view to the rapid increase in minimum clearance with size.

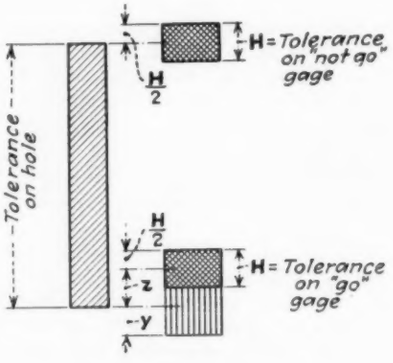


Fig. 3—Bilateral tolerances used for ISA "go" and "not go" gages for holes give the manufacturer two additional tolerance zones to allow for gage wear

The thirteen primary subranges were obtained, up to 180 mm. (7.09 in.) by taking over the subdivisions of earlier metric standards (1, 3, 6, 10, 18, 30, 50, 80, 120 and 180 mm.) and above 180 mm. by adopting a geometric progression according to the preferred numbers series: 250, 315, 400 and 500 mm.

Extreme Work Limits

According to American standard practice, the nominal manufacturing limits of a workpiece are its extreme permissible sizes. Variations in the sizes of the gages should not permit the work to exceed its own limits. Therefore, according to the American viewpoint, the manufacturing tolerances on gages must lie inside the tolerance on the work and a gage is not permitted to wear past a work limit. The latter condition applies primarily to "go" gages, as "not go" gages practically do not wear.

In the ISA system, a "go" gage is made to a basic gage size lying within the work tolerance at a distance *z* from the "go" limit, see Fig. 3. The tolerance *H* on the "go" gage is distributed equally on both sides of the basis gage size. The "go" gage is permitted to wear a distance *y*, past the "go" limit of the work before being rejected as inaccurate. The basic size of a "not go" gage is the "not go" limit of the work. The tolerance *H* is a bilaterad one again: a variation *H*/2 is permissible in each direction from the "not go" limit.

Therefore, in the ISA system, it may happen that workpieces are an amount *y* outside the "go" limit or an amount *H*/2 outside the "not go" limit. The ISA system specifies that such work should be accepted. The manufacturer is thus given the benefit of the two extra tolerance zones when supplying parts to a purchaser.

*The concept "tolerance unit" was explained in the previous article.

Why Cut Away 88 Per Cent of Metal?

M. P. DALTON
Dublin, Ireland

While the reasoning in the article under the title given above (*AM*—Vol. 80, page 257) looks all right, it is usually bunkum. Many designers and production men fail on this waste metal bogey.

It is just a matter of cost. Many parts now made from tubing or drawn from sheet metal would be cheaper if made from bar stock. And it often pays to increase the material and use the scrap.

WHERE WELCOME WAITS

FRED H. COLVIN
Editor

Scroll presented to Fred H. Colvin at a testimonial dinner given for him in Japan in 1929 by a group of Japanese engineers and army and navy officers

IT HAS BEEN my privilege to travel rather extensively, to visit thousands of shops in various parts of this and other countries, and to meet many interesting people. And I still enjoy seeing different shops, noting different methods of performing various operations, and meeting the younger mechanics. While many methods and kinks which are supposed to be new were old when I was a boy, it often happens that a way that is entirely new to me crops up in some small shop I visit. Surprises are likely to be found in out of the way places, not only in methods but in characteristics of individuals.

On one of my first visits to New Orleans I went into a small shop and handed my card to the boss. After glancing at it he put out his hand and said, "Hell, Colvin, I've known you for years," and proceeded to show me a number of interesting kinks.

To some extent the same held true in England and in Japan, the great "kick" coming from a surprise dinner by a number of Japanese engineers in the Navy Club in Tokyo in November, 1929. If I ever had doubts of the extent to which technical articles are read this meeting dispelled them all. For here, 8,000 miles from home, and with an entirely different language, one after another of the men gave his name, his business connection, and told of articles in the *American Machinist*, of information in the Handbook, and of the help they had received from them. The parchment they gave me, bearing the name of each engineer present, in both Japanese and English, is one of my prized possessions.

I had the pleasure of meeting most of these men in their own plants and was shown many interesting devices and methods. Some of these were based on practices in both this country and Europe, as is natural, but I also found ingenious adaptations.

There are but few mechanics who are not willing to share their methods with others. Several men have told me that while they could get no direct benefit from having their methods published, they felt duty bound to give them to the *American Machinist* in return for the many ideas they had secured from others in its columns. It has been my general experience that shops which do not welcome visitors have very little to show them. Men in such shops frequently hug the delusion that they alone know all the worthwhile kinks of the machine business.

One glaring example of this comes to mind. I was walking through a fairly large shop and, as a special privilege, was shown a "new" method of "bulging" salt cellar tops, on condition that it was not to be published. The method was not new, and had been published several times.

Another similar occurrence in the early days of automobile building is typical of the shop-secret era. This was before the planetary cylinder grinder came into use as a method of finishing, cylinder bores being lapped with a dummy piston. A shop in Reading, Pa., had a secret process in which Sapolio (the household scouring soap) was the abrasive used, with kerosene as the lubricant. It was very "hush-hush" as everyone else used emery or a similar abrasive, and this gave a much better and safer finish (?). Shortly afterward another automobile shop, this time in Indianapolis, showed me the same process, which they also thought was a secret. Later I ran across Sapolio being used to run-in crankshaft bearings for racing cars. The theory was that the abrasive in Sapolio broke down after a very little grinding and became harmless, even if it was not all washed out of the bearing.

Nearly all of those who have ideas of shop secrets fail to appreciate the extent to which methods are common property in the great majority of shops. Most managers agree that visitors give as much information as they get.

BETTER TEETH

on HACKSAW BLADES

HERBERT M. DARLING
Superintendent, Wells Tool Company

HACKSAWING MACHINES have been improved so that with accurate guides and controlled feeds they are not only highly efficient, but cut so accurately that very little stock need be removed in squaring the ends of the work. To obtain the full benefit of these machines, the very best hacksaw blades must be used, and the user has his choice of either molybdenum or regular high-speed steel blades, both of which are an immeasurable advance over the older carbon steel blades.

While the saws have been improved in material, the makers cling to the conventional tooth form shown in Fig. 1. There is no front rake and there is too much relief. The tooth shape may be satisfactory if the blades are not resharpened but are thrown away when they get too dull to cut freely, but we have found it economical to sharpen our blades when they get dull. What other tool should be used to destruction and then be discarded without sharpening? None that I know of, and only tradition handed down from the days of the cheaper carbon steel blades causes us to do it.

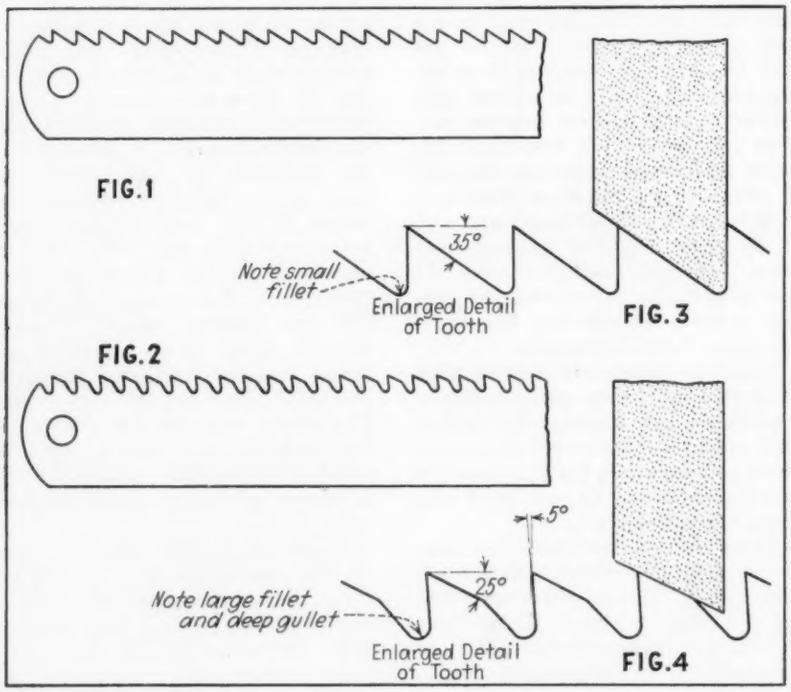
Most production men want ground-thread high-speed steel taps, occasionally for accuracy but more often for longer life. Why shouldn't the same reason apply to hacksaw blades? I believe that the makers should furnish hacksaw blades with teeth sharpened by grinding. The tooth form should be such that the blades could be easily sharpened.

In Fig. 2 is shown the approximate tooth shape of the blades we ought to be able to buy. It has front rake for easy cutting and has a deep gullet, making it easier to sharpen.

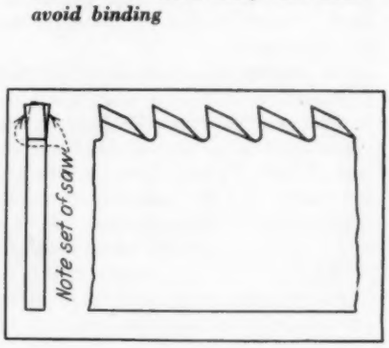
In Fig. 3 is shown the sharpening of the ordinary saw blade. The long line of contact between the saw and the wheel causes excessive heat, which tends to draw the temper and soften the points of the teeth. When it comes to sharpening, the advantage of the tooth form illustrated in Fig. 2 is shown in Fig. 4. There is less metal to be removed, less heating and consequently less chance of drawing the temper of the cutting points. The points, having less relief than that of the present design are stronger and do not become dull so quickly.

Another point to be considered in connection with resharpening hacksaw blades is the amount of "set" to the teeth. If the blades are to be resharpened, they should not be used until the "set" is worn off. If this is properly looked after by the operator, the blades should stand sharpening three or four times. By that time most of the "set" will have been ground away, as shown in Fig. 5. It does not pay to grind a blade beyond this point, or the lack of "set" will cause it to bind in the kerf.

There are several inexpensive saw sharpeners on the market and I believe there should be one in every plant where several sawing machines are in use. Its use will result in saving a large per cent in the cost of blades.



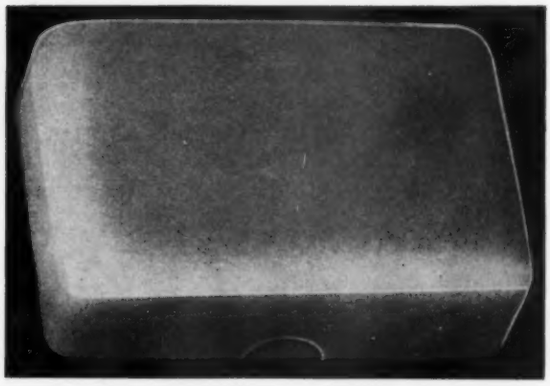
- ***The ordinary commercial blade of today is compared with one with front rakes and deeper gullet for free cutting and easier sharpening***
- ***It pays to resharpen a saw before the "set" is worn away and thus avoid binding***



WHEN CELLULOSE PLASTICS ARE WORKED

Successful results are entirely dependent on the selection of a material having correct fabricating properties, either inherent or induced by modifying plasticizers

ALLEN F. RANDOLPH
Du Pont Viscoloid Company



SWAGING, as used for this soap box, consists in preheating the sheet blank and shaping it in a mold

PLASTICS of cellulose derivatives are compared in this article with regard to the principal operations used to fabricate them into finished products. The various machining operations, such as turning in a lathe, do not raise much of a problem; as a class these plastics, when handled with reasonable precaution, machine easily and well, without rubbing and cracking and usually without the need of a lubricant.

However, considerable care is required in choosing a material for operations which involve distortion or flow of the plastic; these include swaging, blowing, die-pressing and molding.

Swaging, such as is involved in making, for example, a soap box out of a rectangular blank cut from sheeting, comprises putting the sheet into a plastic condition and stretching it by the closing of a metal mold. Plasticity is induced by preheating the blank, as in boiling water or on a steam table. The mold is ordinarily unheated and is closed rapidly so as to shape the material before it has become too much chilled by contact with the metal. The article is removed from the mold as soon as this can be done without distortion and is thrown into water to complete its cooling.

The sheet must stretch as required in a uniform manner. There must be no thin spots formed, and of course, no bursting. The success of the operation, assuming a properly designed mold, is predicated upon uniformity of the material and upon having it in a properly plastic condition. Unexplained failures encountered in spite of ordinary precautions are caused perhaps by the use of material of too high viscosity and sometimes to a too thorough seasoning. A refractory lot of material is frequently improved by being soaked in water for a couple of days.

Time Factors

The time consumed in the operation of swaging and consequently the cost of the operation are influenced by the time required for chilling the article in the mold sufficiently to permit of its removal without distortion, and this is largely dependent upon the magnitude of the interval between the minimum temperature required for satisfactory shaping (molding temperature) and the temperature to which the material must be cooled in order to become substantially rigid again (softening temperature). It is generally desirable in the shaping of thermoplastic materials to have a high rate of softening with increase of temperature above the softening temperature.

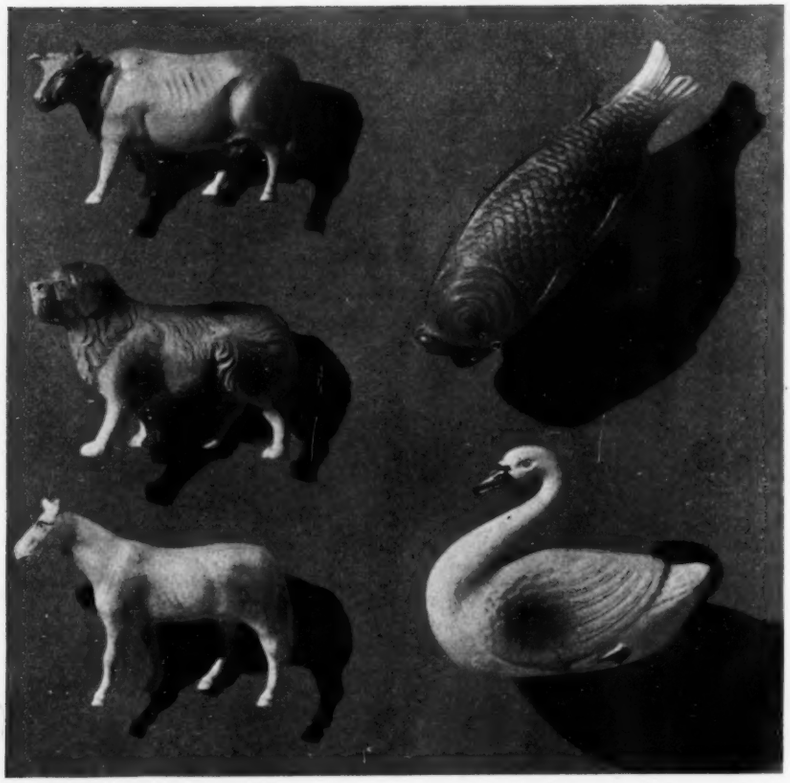
The time consumed is influenced also by the temperature differential between the plastic and the unheated mold. Sheeting of high softening temperature is thus desirable, since it more quickly cools to a rigid condition.

Of the pyroxylin plastics, that made in the ordinary manner with camphor as plasticizer is the most satisfactory, particularly because of its relatively high softening temperature. Pyroxylin plastics made with other plasticizers are in general of lower softening temperature and must be left longer in the die if they are to be removed without distortion.

Blowing is an operation analogous to swaging, applied also to material in sheet form, in which the pressure of hot air or steam is used instead of the pressure of a metal plunger to stretch the sheet material into conformation with a concave mold. It may be illustrated by the fabrication of floating toys.

Two thin sheets of plastic are preheated and placed between two preheated metal plates containing matched half cavities, which are connected by a system of grooves leading from an en-

Presented at the seventh annual meeting of the Society of Rheology



BLOWING formed these floating toys by forcing hot air or steam between two sheets held between half molds

trance groove at one edge of the plate. The whole system is placed under hydraulic pressure and a tiny nozzle is inserted between the sheets at the entrance groove. Steam or hot air is thereby forced between the sheets at all points where the sheets are not held together in contact between the faces of the mold. This fluid pressure bellies out the sheets against the walls of the cavities. Then the whole system is chilled.

Similar to Swaging

Here the requirements are obviously quite similar to those for swaging, but in general the sheets are thinner and the stretch relatively greater. There is, however, the further requirement that the two halves of each article be welded together by the heat and pressure, without the aid of cement or solvent. The ordinary pyroxylin plastic cannot be welded in this way, and consequently it is necessary to use for this purpose certain special compositions, which are valueless for most purposes.

A combination of swaging and blowing is applied to the formation of certain articles which cannot be formed by swaging alone, such as a circular container with shoulders. In this case a plunger effects most of the vertical stretching and then steam entering through perforations in the plunger swells the sheet out against the concave mold, which is of course split so that the article may be removed.

Swaging and blowing are thus used for the production of thin-walled articles. Die-pressing is applied to massive articles, and involves merely the change in configuration of a massive blank of suitable size and of a simple shape as nearly as conveniently approximating that of the finished article. Thus toothbrush handles are made from pieces of sheeting cut to rods of proper length and width, dice from cubes cut from sheeting or from short lengths of cylindrical rod, and combs from rectangular blanks. Here again the blank is preheated to save time. The die must usually be heated and then cooled, although a few articles permit of the use of an unheated die. The shaped article is removed from the die as soon as it is cool enough to hold its shape.

Here again camphor is the best plasticizer for nitrocellulose and permits of the fastest operation. It is remarkable that this plasticizer used by Parkes, Spill and Hyatt 65 years ago, and which in Hyatt's original method of making the plastic was about the most difficult one to use that he could have chosen, still holds its place today as the preeminent plasticizer for pyroxylin plastics, in the face of the hundreds of others developed in the course of the subsequent advance in organic synthesis.

Finishing Practice

In the operations of finishing these articles of pyroxylin plastics, usually comprising a coarse smoothing by pumice powder followed by a polishing with finer and milder abrasives, again a camphor plastic is better than those made with most substitutes. Considerable heat is developed as the operator holds the article against a rapidly spinning cloth wheel, and the lower softening temperatures which characterize the latter cause them to become superficially softened, if the work is carried out at normal rapidity, so that they will not take a satisfactorily smooth finish.

The methods of fabrication thus far mentioned have involved only the distortion of an integral mass of material. There has been no requirement of welding together of discrete particles by the application of heat and pressure, except in the special case of joining the halves of thin blown articles, which is accomplished by the use of a special composition. And because the pyroxylin plastics in seasoned condition are in general incapable of being welded together by heat and pressure, because decomposition sets in before a welding temperature is reached, the methods thus far mentioned are characteristically those for the pyroxylin plastics. These methods are somewhat limited in scope, and in most cases they involve considerable waste of material, both in the cutting of blanks (e.g. the loss of at least 22 per cent in the cutting of circular blanks from a rectangular sheet) and also in excess material squeezed out or cut off around the edge of an article.

The greater part of this waste can be obviated if a granular or powdered material can be weighed out in quantity just sufficient to yield a desired article and then be welded into a homogeneous solid mass in a mold of the shape of that article. This is molding in the narrower sense of that word as used in the trade.

If a pyroxylin plastic in granular form be subjected to pressure in a hot mold, at a temperature which will not

cause decomposition, the separate particles appear to have coalesced into a solid continuous mass of good appearance, but the article is readily broken into fragments. The original granules have been merely distorted and wedged together, but not welded together. Increase the plasticizer content sufficiently and a properly welded article can be made, but only at sacrifice of rigidity. Add a filler to bolster up the rigidity, and the result is a compound which molds badly and yields articles which are not only weak and brittle but still of so low a softening temperature that will sag in warm sunshine.

Welding Is Easy

Cellulose acetate, however, can be made to weld together even without any plasticizer, although only at such temperatures as will cause discoloration and at pressures beyond the commercial range. But comparatively little plasticizer is required to make cellulose acetate capable of being welded to itself at reasonable temperatures and pressures—temperatures say from 150 C down to 120 C, which are on the safe side from the standpoint of discoloration, and pressures from 3,000 down to 1,000 lb. per sq.in. (210 to 70 kg. per sq.cm.) which are economical and low enough to avoid damage to molds. Such cellulose acetate compounds are now available as commercial products, and it is probable that similar compounds of ethyl and benzyl cellulose will become so.

The molds, usually of steel, are made to the exact size and shape of the desired article, with allowance for thermal shrinkage, and are highly polished. The molded article requires only to have rubbed off the overflow or "flash" which squeezes out of the mold. The granular molding compound is ordinarily run through a pelleting machine, which not only measures out the charge so accurately that the necessary overflow is a minimum but also packs the charge into a firm tablet which is more easily loaded into the mold. The tablet is dropped into the hot mold and is rendered plastic by the heat. Hydraulic pressure causes it to flow into position in the die, and the combination of heat and pressure causes the particles to coalesce into a continuous homogeneous mass. This must then be cooled, while still under pressure, until rigid enough to be removed.

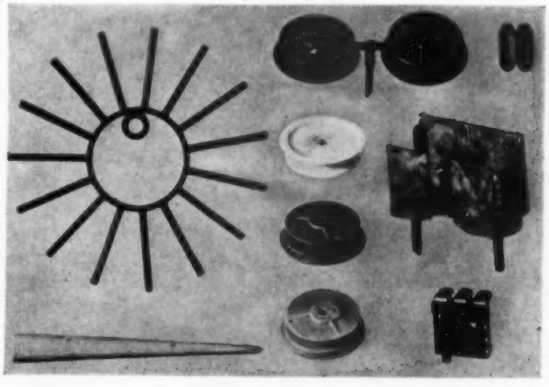
Commercial molds for this so-called thermoplastic compression molding are cored or jacketed for circulation of steam and of cold water, and generously so, in order that the necessary heating and cooling may be accomplished rapidly. Both in construction of molds and in the conduct of the molding operation the thermoplastic materials are generally at a disadvantage compared to the heat-setting molding compounds of the phenol-formaldehyde type. Molds for thermoplastics must be better cored than those for the heat-setting resins, which normally are required merely to be maintained at the same temperature all day long. Hence in molds for thermo-plastics there is a temptation to weaken the structure by oversized channels, in order to get quick action. And the recurring alternation of heat and cold frequently results in leakage. In general also the total cycle of heating and cooling required by thermoplastic material is longer than the time which must be provided for the heating and setting of a heat-setting material, although in exceptionally well-designed dies the difference may be found to be negligible.

The method of injection molding for thermoplastic molding compounds, notably cellulose acetate, is now coming into extensive use, particularly for the fabrication of articles which by reason of complications of design cannot economically be made by the conventional technique of compression molding.

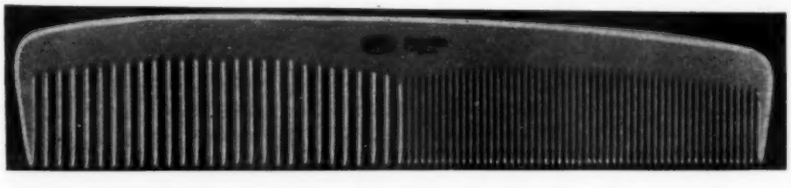
In contradistinction to compression molding, in which a weighed amount of molding compound is placed in an open mold and the mold then closed by hydraulic pressure, injection molding involves the use of a mold initially closed, and connected by a duct to a chamber containing the molding compound maintained in a plastic condition by heat. The thrust of a plunger upon the mass in the heating chamber forces material through the duct to fill the mold. Essential to the process is a constricted orifice leading from the heating chamber into a duct of small diameter; the constriction assists in heating and homogenizing the mass, and the small diameter of the duct enables the sprue connecting the article with the reservoir to be easily broken upon withdrawing of the mold. Essential also to operation with economical speed is the use of an unheated mold, wherein the compound hardens quickly by chilling, so that the cycle of operation is very short compared to that of compression molding and sufficiently so in some cases to offset the greater capacity obtainable in compression molding equipment.

Since on the one hand the heated compound must be fluid enough to be forced rapidly into the mold through the duct and to fill the mold fully and perfectly, and since on the other hand it is essential, for economical production, that the mass in the unheated mold shall thereafter become rigid as soon as possible, it is evident that here again a small, rather than a large, interval of time between softening and molding temperatures is of vital importance.

Conceivably it might be possible to



INJECTION MOLDING uses a closed unheated mold into which the heated plastic is forced under pressure



DIE-PRESSING usually involves the use of preheated plastic treated with camphor for fast operation

go too far in this direction, so that the compound entering the mold would harden too fast, as for instance, before it could be forced into the shape of the die, but such a condition is probably never encountered in practical work with compounds capable of being made sufficiently fluid at ordinary operating temperatures. These relationships for three compounds of the same softening temperature are shown qualitatively in Fig. 1, in which Compound *A* is unsatisfactory because its mobility-temperature curve is not steep enough, *B* is satisfactory and *C* is unsatisfactory because it hardens too abruptly.

Various Plasticizers

With cellulose acetate, and still less with ethyl cellulose and benzyl cellulose, there is no unanimity of selection of plasticizers, and for these derivatives there is no one plasticizer which stands out with unique excellent properties, as does camphor with pyroxylin. Various alkyl phthalates are in general use with cellulose acetate, and also aryl phosphates, triacetin, toluene sulphonamides, etc. The problem involves the selection of a plasticizer (or mixture) and the use of it in proper proportion so as to secure desirable flow properties during manufacture and fabrication, and a suitable rate of softening above the softening temperature, and at the same time satisfactory toughness, rigidity and hardness in the finished article.

The selection of a plasticizer and of the proportion in which it is to be used ordinarily involves a compromise between conflicting requirements. Rigidity and high softening temperature call for a low content of plasticizer, whereas ease of molding and impact strength are promoted by higher contents. Some plasticizers allow of more latitude than others, as may be seen through comparison of the two idealized diagrams of Fig. 2, which represent the characteristics imparted by hypothetical plasticizers *A* and *B*.

The minimum temperature required for molding (under the molding pressure available, and for production at commercial speed) is what has already been referred to as the molding temperature. Its decrease with increase of plasticizer content is indicated by the upper lines of the diagrams [1], [2]. The decrease in softening temperature[3] is similarly shown, as are also the decrease in rigidity[4] and the increase in impact strength[5] which normally accompany an increase in plasticizer content.

The "maximum temperature available for molding" is either the highest obtainable with the available steam supply or else the highest which can be applied without discoloring the plastic. The plastic must be moldable at commercial speed at a temperature not above this maximum. Hence plasticizer *A* is not usable in proportions less than *M* per cent, nor plasticizer *B* in proportions less than *P* per cent. The "minimum permissible softening temperature" is dependent upon the use to which the molded article is to be put. The plastic must not soften at any lower temperature than this. Hence plasticizer *A* is not usable in proportions greater than *N* per cent, nor plasticizer *B* in proportions greater than *Q* per cent. Within these respective useful ranges *MN* and *PQ* a selection may be made of the best compromise between rigidity and strength, but obviously the narrow range *MN* gives considerably less latitude of choice than does the wider range *PQ*.

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[1] *For this and the other relationships straight lines are used for the sake of simplicity. In practical work it is seldom necessary to develop enough data to form the basis for complete curves.*

[2] *The flow properties of thermoplastic materials of this type could no doubt be investigated with the aid of methods and equipment already described in the literature but designed in most cases for use with heat-setting resins, e.g.:*

Giorn. chim. ind. applicata Vol. 5—342 (1923); Ind. Eng. Chem. Vol. 21—770 (1929); Ind. Eng. Chem., Anal. Ed. Vol. 1—158 (1929); U.S.P. 1988597; Plastische Massen Vol. 1—104 (1931); Vol. 4—157, 189 (1934); Elektrotech. Z. Vol. 14—439, 850 (1931); Plastics Vol. 7—271 (1931); Plastic Products Vol. 10—53, 93, 132 (1934); British Plastics Year Book (1933) page 68; (1935) page 47; British Plastics Vol. 6—54 (1934); Physics Vol. 4—225 (1933); Vol. 4—285 (1933).

[3] *Softening temperature is measured by various semi-scientific tests designed to determine at what temperature the material becomes permanently deformed by a small stress.*

[4] *Rigidity is normally judged by simple inspection, i.e., squeezing or bending the article.*

[5] *A.S.T.M. Test D256-34T.*

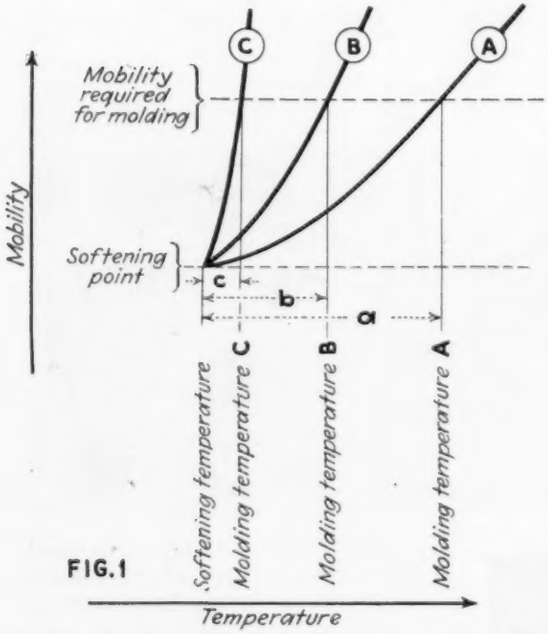


FIG. 1

Fig. 1—Three materials may have the same softening temperature, but because of steepness of the temperature-mobility curves, only one may be suitable for injection molding

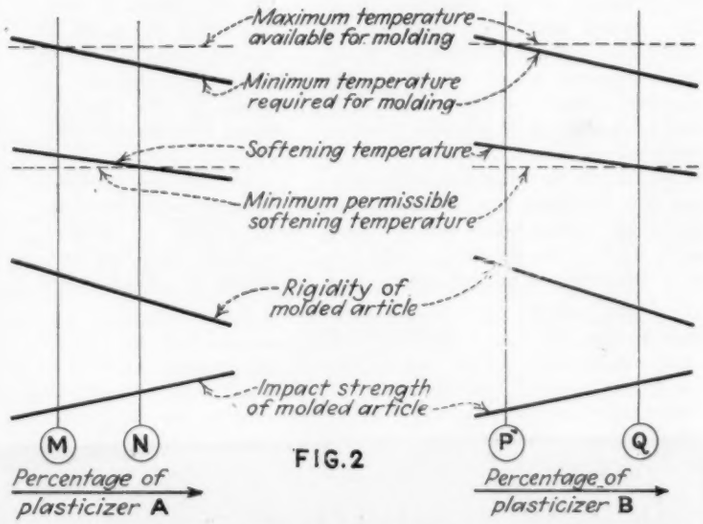


FIG. 2

Fig. 2—Since different plasticizers affect materials in varying degrees, some permit more latitude than others in obtaining the desired characteristics

Talking Shop

One mid-Western gear manufacturer is protecting threads in gears during hardening by first applying a copper coating with a brush. In many cases it is cheaper to apply the material to the threads in this manner than by the usual copper plating process.

Double Check

Inspection gages are common to all manufacturing shops. But the inspection of inspection gages is another story. Too often they are permitted to wear without being checked. Some large plants have a corps of gage checkers who circulate through production departments and keep tabs on all the gages used. Worn gages can cause a lot of trouble.

President Compton of M.I.T. told a New York meeting recently that federal scientific bureaus are staffed by able men, that they are hampered by bureaucratic inertia and jealousy, that they are guilty of duplicate and uncoordinated effort, that they start many projects and stop hardly any, but that they accomplish a lot notwithstanding. Here is an obvious opportunity for statesmanship in administration rather than partisan political opportunism.

Power Saving

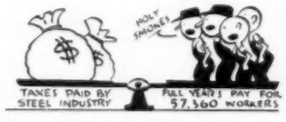
Avoiding peak loads can save a lot of dollars on the power bill. One railroad shop official recently told of saving about $350 per month by staggering work between his machine and woodworking shops. The machine shop quits work at 4 p.m. and the wood shop starts at the same time. Woodworking machines take a lot of power, and the two shops together made a high peak load. This plan may have application in other industries.

Steel Stiffness

Boring long holes of small diameter invites spring in the cutting tool. So the toolmaker wants to know the stiffest kind of steel for the bar; and he is surprised to find that it makes very little difference, as the stiffness of carbon steels is surprisingly uniform regardless of the contents or heat-treatment. Nickel and tungsten add a little to the stiffness but not as much as might be supposed. Seems odd but that's what the steel men tell us.

Taxes or Wages

Equivalent to a full year's pay for 57,360 wage earners, the American steel industry paid nearly $73,000,000 in taxes in 1935. This tax bill was almost



double the total dividends paid by the 127 reporting companies, members of the American Iron & Steel Institute, according to *Steel Facts*.

Observers at the Leipzig Technical Fair noted something of a swing back to plain bearings for applications demanding extreme accuracy and ready adjustment. There are even a few designers over here who will admit privately that we may have overdone ball and roller bearing applications in a few spots.

Cadmium for Lubrication

By far the largest user of beryllium copper is the International Business Machines Corporation. It is the material best suited for small spring clips but it is most stubborn stuff to form. Dies in a four-slide machine looked like badly abused drop forging dies after 15,000 blows. Every trick known to steel specialists and metallurgists was tried without avail until L. C. Conradi, I.B.M. chief metallurgist, concluded that what the dies needed was lubrication. Well aware of the lubricating properties of cadmium he had several coils of stock cadmium plated and tried them out. This did the trick for the dies showed slight wear after 120,000 blows.

Long Service Roller Bearings

A rather striking example of the application of roller bearings to locomotive side rods is the Pennsylvania 4-6-2, or Pacific type, with nearly 100,000 miles to its credit. An interesting feature is the reduction of weight in the revolving and reciprocating parts. Here the saving was over a third of the weight of the regular plain bearing design. Railways should afford a wide and fertile field for the use of anti-friction bearings.

Rating Men

Six questions, to be answered by a foreman in regard to the men working under him form the basis of a rating procedure which has gone into effect at the Pontiac Motor Company. They are: (1) does he do good work?;

(2) does he do his share?; (3) is he careful with company property?; (4) does he work well with others?; (5) is he a clean, orderly and safe worker?; and (6) does he work steadily? Maximum value points are assigned each question, the first two having 20 points each, the others 15 each. The ratings, made once a month, aren't intended to be a final summary of a man's value, but to help the workman improve himself on his job. Ratings are used only within departments, no comparisons being made between departments.

The Editors.

DIE DESIGN and DIE MAKING

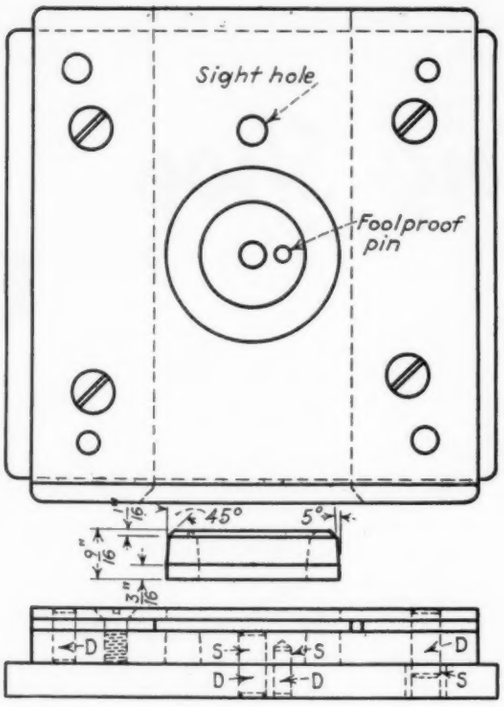


Fig. 34—Even for a few experimental parts a compound die may be needed; this type is used between planish blocks

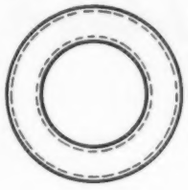


FIG. 34

E. G. MARSHALL
Master Mechanic, Charleston Works
The American Fork & Hoe Company

VIII—Compound dies produce the highest quality work, but their complexity requires the best of workmanship

INDIVIDUAL operations such as blanking and piercing are combined in compound dies instead of being separated as in progressive dies. Thus, both the upper and lower members have punch and die elements, and often strippers or ejectors.

The highest quality work is produced in compound dies. The relation of the pierced holes and the outline of the blank can be held more accurately than in any other type. By piercing and blanking in one operation the part is left flat and the burrs are on the same side.

Compound dies are safer for the operator, because they do not need finger clearance, cutting being done from the strip. The stroke of the press can be cut down, thus reducing the cutting speed for the same press speed.

For those who want the quality gained by compound dies, and yet the production is low such as for experimental parts, the die shown in Fig. 34 is recommended. This is probably the lowest-priced compound die obtainable, being almost as cheap as a low-production blank die. The labor cost is higher because of the way in which the die must be taken apart on each blank. For this reason everything possible should be done to make operation easy and quick. The die is used between planish blocks and is operated like a temporary blank die. A loading table should be attached to the front of the press to aid the operator.

Simplified Operation Routine

The following routine is followed in operating the die. The piercing punch is placed over the dowel and pin in the baseplate and the die proper (die block, stock guides and locater plate) placed on top of the baseplate and located by the dowels. Then the strip is pushed in until the end shows in the sight hole. The blanking punch is placed on top of the strip in the opening provided in the locater plate. The die is placed between planish blocks and the press is tripped.

To unload the die, lift the die proper off the baseplate. This is made easy by making the baseplate longer one way and shorter the other than the die block so as to give a hand hold. Then lift the blanking punch off the part and baseplate. Lift the piercing punch off the baseplate. Finally, lift the part off the baseplate and the die is ready for the next cycle.

When machining this die, the die block should be made first. Oil-hardening tool steel ⅜ in. thick is used. The blank opening should be laid out central and the usual taper of ½ deg. employed. Dowel holes are drilled and reamed and stock allowed for lapping or grinding to size after hardening. Tap the screw holes 0.003 in. oversize so that the screws will enter after hardening. The die block can then be hardened.

The piercing punch is made to suit the outline and size of the hole. It is also ⅜ in. thick. The main dowel hole is placed in the center. Before heat-treatment the piercing punch should be located inside the die opening correctly and the foolproof dowel hole drilled in the base and punch. The punch is made of tool steel.

The blanking punch is made of tool

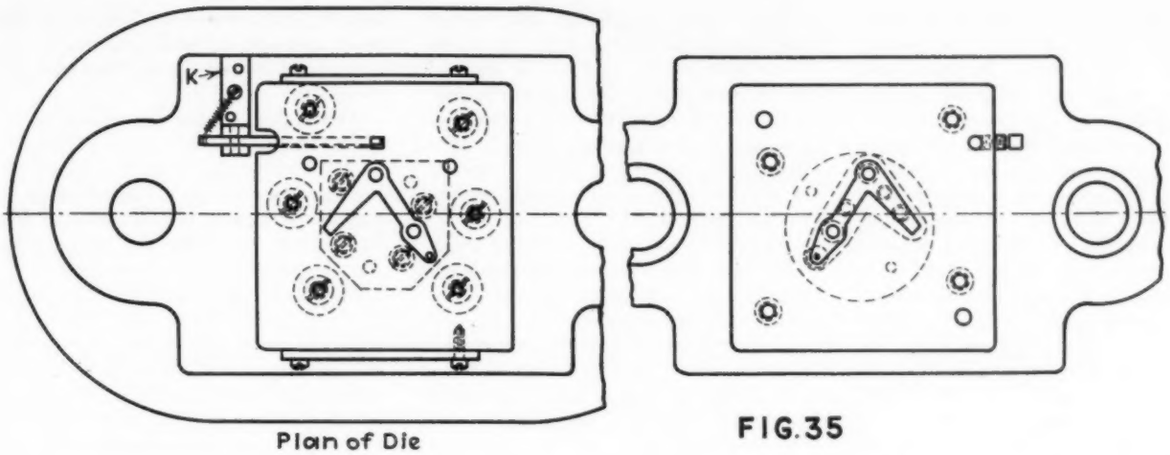


FIG. 35

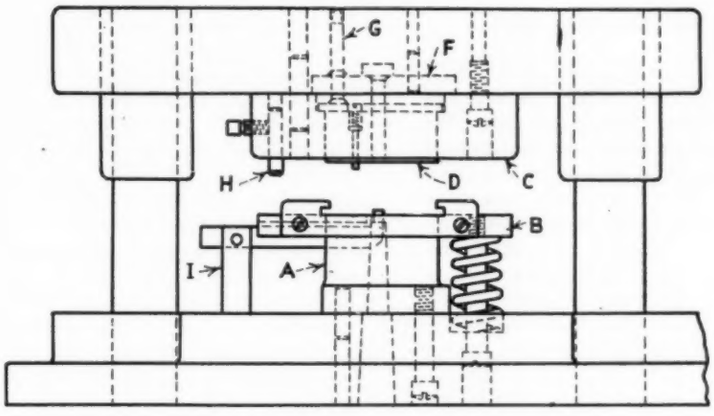


Fig. 35—Both members of this high-production die contain punch elements; the lower member the blanking punch; the upper member the three piercers

steel ⅜ in. thick, the outline being scribed from the die block and machined to the outside of the line. The punch is then sheared in the die block and relieved to give the required clearance for the thickness of the stock. The pierce opening is laid out and machined to size. If desired, this can also be sheared over the piercing punch. Clearance for the piercing punch is allowed in the piercing opening in the blanking punch. After this has been done the top taper and the chamfer can be machined and the punch hardened.

The locater plate has an opening in the center machined or hand filed to be a snug sliding fit all around the periphery of the blanking punch. This part is made of ⅛-in. cold-rolled steel. It is located and clamped on the die block and the screw and dowel holes transferred. The baseplate is likewise clamped under the die block and two of the dowel holes are transferred. These dowel holes are bushed because the baseplate is made of cold-rolled steel. Dowels for the piercing punch are a drive fit in this plate.

A mounted compound die is shown in Fig. 35. Punch *A* is on the lower member with the stripper *B*, while the die block *C* is on the upper member. The stock is ejected from the die block by the shedder *D*. If the press is inclined the part will fall down back of the lower member and slide into the stock pan.

Die block *C* is made of tool steel, hardened and ground. It is screwed and doweled to the upper member. The heads of the screws are in the die block which is counterbored to within ¼ in. of the top to allow as much grinding for sharpening as possible. The walls in

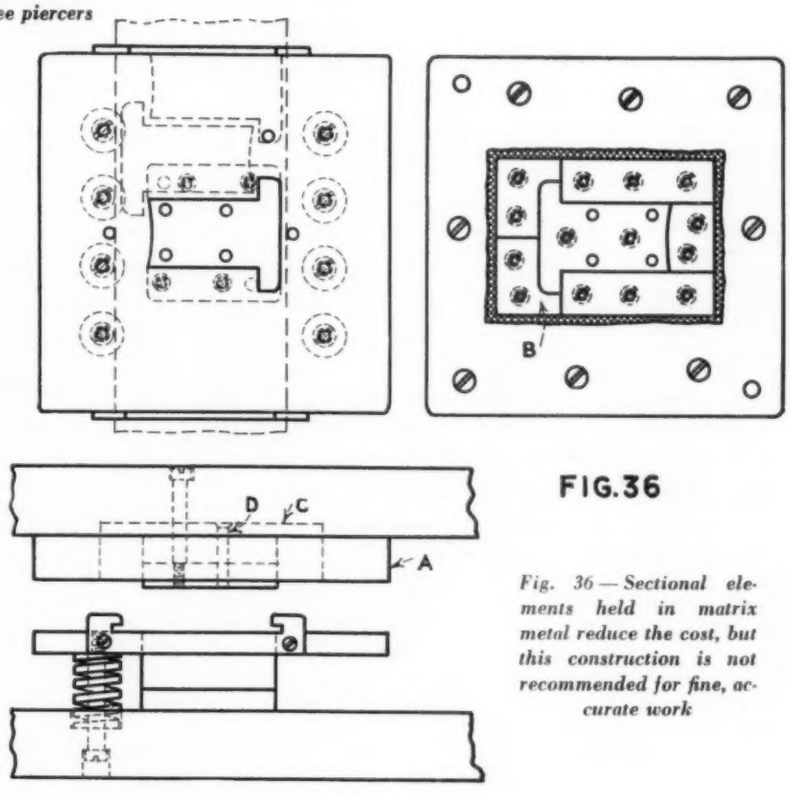


FIG. 36

Fig. 36 — Sectional elements held in matrix metal reduce the cost, but this construction is not recommended for fine, accurate work

the blank opening should be straight.

Shedder *D*, which acts as an ejector, is made of tool steel, hardened and ground. In this die the shedder is made in one piece, but when the shape of the shedder will permit it should be made in two pieces. One will be the shedder proper and the other a retaining plate. The latter is made of ⅛-in. cold-rolled steel and casehardened. It is attached to the main body of the shedder by means of 8-32 flat head screws to save time in machining. The shedder should extend ☆ in. below the die block.

The upper member is recessed to receive the punch plate *F* which is made of cold-rolled steel. It furnishes a mounting for the piercers, and the die block clamps it in place. The outside surface is ground flush with the face of the upper member casting. Two dowels driven in the punch plate and the casting prevent movement. The piercers

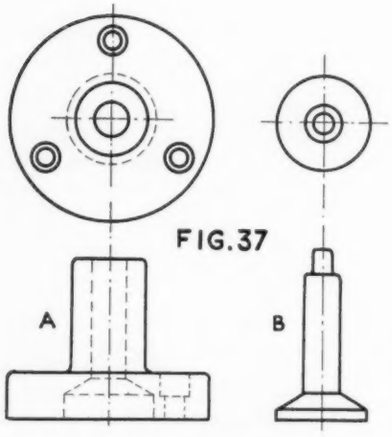


FIG. 37

Fig. 37—A standard adapter can be attached to the upper member to operate knockout pins G in Fig. 37

are mounted with 0.002 in. play so that they can be aligned by the shedder. A back-up plug of hardened drill rod prevents the head of the piercers from bedding into the casting. Knockout pins *G* are operated by a knockout bar which is part of the punch press. They in turn operate the shedder. The top ends of the knockout pins come slightly below the top surface of the subpress, causing the knockout bar in the press to hit the casting if the adjustment is wrong. If the knockout pins were to project above the sub-press, faulty setup might break the shedder. Pin *H* is used to operate the automatic stop.

The blanking punch *A* is machined the same as the punch described previously (*AM*—Vol. 80, p. 342) except that the piercing holes are bored in it. These holes are straight on the top end for ⅛ in. and then are tapered ¼ deg. on a side. The punch is made from tool steel and is hardened and ground. It is attached to the lower member by means of fillister screws, the heads coming within the casting.

Stripper *B* is made of ⅜-in. cold-rolled steel and is attached to the lower member with shoulder screws. It is held under spring pressure.

A square post *I* with the end turned round and driven into the die shoe has a slot in the top to mount the automatic stop. A small plate *K* prevents the post from turning.

Matrix Metal in Dies

A mounted compound die which is cheaper to build than the type shown in Fig. 35 is illustrated in Fig. 36. The die sections are backed up and located by maxtrix metal poured around them in place of dowels. The part to be made is a lamination for pole cores of an electric motor. This die is not recommended for fine, accurate work.

Die block *A* is made of hot rolled steel or boiler plate. It is fastened to the upper member with fillister-head screws and is doweled. Die sections *B* are made of tool steel or high-speed steel depending on the volume of production. They are rough machined all over and finished to size on the cutting edge only, and then drilled and tapped for the screw that attaches them to the upper member. The die sections are carefully located and screwed in place in the die block and matrix metal is poured in the clearance between the sections and the die block.

The upper member is recessed to receive the punch plate *C*. This part is made of cold-rolled steel and bored for the piercing punches. The punch plate can also be located in position with matrix metal. It is clamped in place by the screws through the die sections.

Piercers *D* are made of high-speed steel and are hardened. They are mounted in the punch plate and cleared in the stripper. The latter is a cold-rolled plate made to fit in the blank opening and around the piercers. It is held in place and operated by the shoulder knockout screws, which are made of hardened tool steel. The punch is made of high-speed steel hardened and ground and machined and fitted in a manner similar to that previously described.

The standard adapter shown in Fig. 37 may be attached as needed to several different dies. The adapter is attached to the upper member where the shank would be and the plunger acts upon the knockout pins *G* in Fig. 35. The top of the plunger limits on an adjustable stop on the up stroke. This forces the plunger down on the knockout pins, thus actuating the shedder and ejecting the part.

The die designer should be careful to place the knockout pins in a circle the same size at least as the bottom end of the plunger. Tool steel, hardened, is used for the plunger and cold-rolled or machine steel for the outer shell.

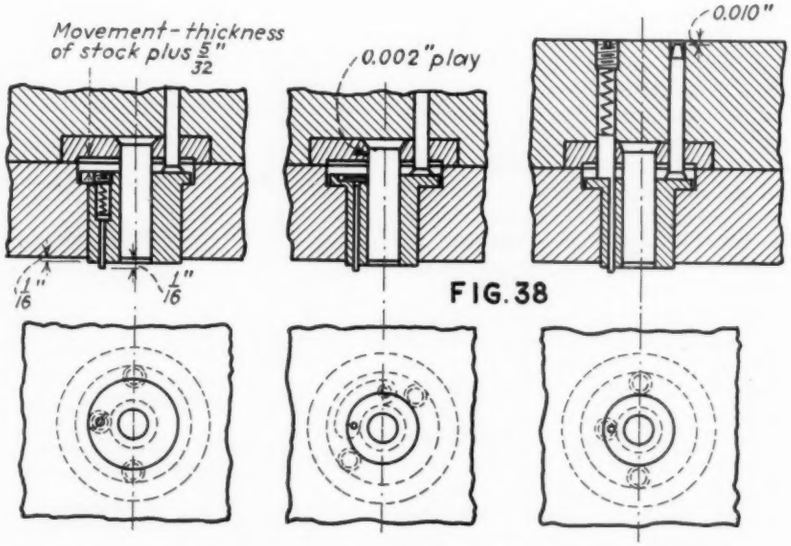


FIG. 38

Fig. 38—These three types of push off pins are used in compound dies to overcome the adherence of oily blanks to the shedder

Editorials

AMERICAN MACHINIST ESTABLISHED 1877
VOLUME 80 NUMBER 15
K. H. CONDIT • F. H. COLVIN
EDITORS

"FOR THE DURATION OF THE WAR"

FROM Franklin Field in Philadelphia, Mr. Roosevelt told the radio audience that he was enlisting "for the duration of the war." In defining his enemies he was diplomatically vague, contenting himself with a reference to "economic royalists."

John L. Lewis, his pugnacious and vigorous supporter, is not so reticent. He names some of the "royalists," and promises to prosecute them if they interfere with his majestic drive to organize the steel industry. He chooses to ignore the fact that the Wagner Labor Relations Act, under which he would start legal action, has been declared void by every court up to the United States Supreme Court where a case is now pending.

As an opponent, Mr. Lewis is not to be taken lightly. His high estimate of his own ability as a leader is well founded on fact. And his easy victory over the coal operators in 1933 has not been forgotten by anyone in industrial circles. In this drive he is surrounded by some of the ablest organizers in labor circles.

Perhaps this is only a skirmish in Mr. Roosevelt's war, but it promises to be a very important one. The call has also been sounded for the automobile, lumber and rubber workers to organize into industrial unions. Success in those fields hinges on a successful outcome of the fight with the steel executives.

The outcome of the skirmish lies in the hands of the steel mill employees. Most of them belong to works councils or other representation plans—over ninety per cent voted in the recent elections held by some of these groups. not over five per cent belonged to the old line union at the beginning of the Lewis campaign. Under the "company union" plan they have been winning three-quarters of the arguments with management.

Why should they change? Well, some of them will find it hard to resist the glowing promises of the organizers. Others will yield to the "peaceful" persuasion that labor leaders understand so well. Anyone who has been on the receiving end of that kind of persuasion knows what it does to peace of mind. On the other hand the workers have seniority rights, many of them. And most of them will sacrifice pensions if they quit.

THE FIGHT is on in steel. Other fights will follow. The sane thing for employers in threatened fields to do is to look over their own labor relations to make sure they have done everything they can or should to give their own men a fair break, or a little more.

Unless Mr. Lewis fails quickly in this skirmish, or gets so involved in his fight for power with Mr. Green that the rank and file get disgusted, this is going to be a long war. Many of us will be in it for the "duration." Perhaps longer than Mr. Roosevelt.

Standards

IN THE various comments we have made on the Eastman report on mechanical problems of the railroads some emphasis has been placed on the need for standards. A few standard types of locomotives would be far easier to service and maintain than the heterogeneous lot with which the average shop foreman has to contend. Some sort of a standard of performance after repair is advocated by Mr. Eastman's experts.

All of this is convincing evidence of the fact that engineering ideas are finding more favor among railroad executives and that the old school of blacksmiths and yardmasters is giving place to younger men with a different point of view.

Such being the case, there is a splendid opportunity for the Railroad Division of the American Society of Mechanical Engineers to do a job that is not being done by any other group in the railroad field. With their excellent contacts with other kinds of mechanical engineers through the medium of the Society, they should be able to solve railroad mechanical problems that have baffled others. Incidentally, the Machine Shop Practice Division of the Society should be eager to cooperate in this work.

Standards are valuable things if they are not overdone. They must not be allowed to interfere with invention and improvement. On the other hand, improvements in locomotives must pay for themselves just as surely as corresponding improvements in machine tools must pay out. It is an engineer's job to find the right compromise between improvement and standardization.

Chips

WASHINGTON—Ship subsidy and Walsh-Healey bills signed by President . . . Army Air Corps plans Alaskan air base, first of several authorized . . . Farm controls slackened as drought advances, Roosevelt takes command of relief measures, may modify work relief program . . . Farley decides not to resign as Postmaster General after all, thereby maintaining an almost perfect record of adhering to jobs, takes leave of absence instead . . . Roosevelt starts on his vacation cruise with the comforting assurance from John Lewis that labor is solidly behind him . . . Drought-ruined farmers will get a year's moratorium on interest owed on government loans . . . Administration starts supplementary attack on steel operators with threat of investigation of collusive bidding by Attorney General Cummings to divert attention from organizing activities of C.I.O.

FOREIGN—Fascist journalists are thrown out of League meeting for heckling Haille Selassie . . . Sanctions ended as recognition of Ethiopian conquest is refused . . . Great Britain plans to build heavier sister ship for *Queen Mary*, starts work on huge new airport for land and sea planes, asks another £27,000,000 for defense program . . . German government orders all Nazis to be hosts to Olympic guests, which means that the job will be well done, offers agreement guaranteeing independence of Austria to prevent entente between Italy and Russia . . . Japan will execute 17 officers implicated in massacre of last February . . . Guerilla warfare resumed in Ethiopia by uncaptured independent chieftains, as dethroned emperor returns to England to plan for further resistance.

FINANCE—Morgenthau reports biggest debt on record, says income is rising . . . WPA gets million to complete tax study . . . Federal receipts in last fiscal year were 46 per cent of expenditures . . . Banks have reduced RFC interests in them by 25 per cent . . . RFC ready to issue equipment trust loans to motor carriers, has already done so for transport airplanes.

INDUSTRY—Steel industry starts concerted move to combat closed shop drive of Lewis C.I.O. group . . . Pennsylvania's lieutenant-governor, a union official, promises state aid for steel workers who lose jobs . . . Federation cites ten C.I.O. unions for separatist attempt, prepares to drop them and with them one-third of its members . . . Cincinnati Circuit Court sets aside Labor Board order . . . First Labor Board case reaches Supreme Court . . . Riot call sounded as RCA Camden strike fight spreads to Philadelphia . . . Stoning of buses marks last gasps of Rand strike as management reports production at 90 per cent . . . Steel mills believed to be at capacity of production on efficient equipment . . . Green says ending of NRA cost over 800,000 jobs in report that is based on mathematical statistics, facts not being available . . . Union Pacific to start laboratory research in railway equipment.

TRADE—Failure of German delegation to shake American determination to establish countervailing duties means drop in trade between the two countries . . . Foreign Trade Council finds prospect for better trade promising, with industrial machinery exports leading.

INDICATORS—Steel output yields but little of its high performance . . . Electric power production continues near peak . . . *Business Week's* index rises 1½ points to 75.8.

Machinery Blazes Path of Recovery

Industry's Activity Is Cited as Sound Indication of Depression's Wane

Visible evidence of renewed activity in nearly all branches of the machinery trade of the United States are among the soundest of indications that the country is in fact emerging from the depression, according to "Review of the American Machinery Industries" issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Factors such as the delayed purchases of machinery and equipment and the existence of vast reserves of credit, point to definite expansion in the various machinery industries and present trends fully justifying the feeling of optimism generally prevailing within the industry group, the review stated.

The significance of the machinery industries in the national economy of this country is indicated by the fact that in 1933, the latest period for which complete statistical data are available, the machinery industries, as a group, employed approximately 500,000 wage earners, paid more than $500,000,000 in wages, and produced commodities valued at approximately $2,000,000,000.

Although the machinery industries as a group have lost considerable ground since 1929, this group was ranked officially in 1933 as fifth in the number of establishments in the manufacturing field of the United States, fourth as to number of wage earners employed, and fifth in product value.

Since 1933, the review states, the machinery business has improved vastly, employment is greater, pay rolls are larger, and the value of commodities produced is higher.

Facts and figures are included concerning the significance of machinery to American economic life.

It was prepared by R. E. W. Harrison, former chief of the machinery division, and Charles O. Thompson, marketing research division, Bureau of Foreign and Domestic Commerce.

VISITS U. S.

British Machinery Executive and Party Entertains in New York

OSCAR HARMER, director of Alfred Herbert, Ltd., Coventry, England, visited New York last week with a party including his daughter, making a return trip on the R. M. S. *Queen Mary*. He entertained friends while here. His firm is a leading machinery builder in the United Kingdom.

Economic Factors Fail To Explain Strikes

Theory That Labor Unrest Is Protest Against Conditions Appears To Be Refuted

The trend of economic factors affords no explanation of the increase in strikes since 1932, according to an analysis by the National Industrial Conference Board.

Since strikes are supposedly protests against working conditions, or against living conditions made necessary by inadequate earnings, the board's study point out, there should be considerable correspondence between industrial disputes and those economic factors which bear directly upon the industrial situation. From 1927 through 1932, the average number of persons on strike follows fairly closely the trend of economic factors. Beginning in 1932, however, the number on strike shows complete independence of economic factors.

LAMBORN PROMOTED BY DODGE DIVISION

Production Chief Elected Vice-President of Chrysler Corp. Unit

FRED J. LAMBORN, formerly works head and operating manager of Dodge division of Chrysler Corp., Detroit, has been appointed vice-president in charge of manufacturing, WILLIAM J. O'NEIL, general manager of Dodge Bros., announced.

He has been associated with Dodge for 25 years and recently has been the operating manager. He has served as general foreman of the tool department, master mechanic of the ordnance plant (during the war) and master mechanic of the Dodge passenger car and Dodge truck factories.

BEGINS $200,000 PLANT

Reynolds Spring Expands to Handle New Automotive Product

Reynolds Spring Co., Jackson, Mich., has started construction of an addition to its Water Street plant in Jackson to cost $200,000. Over 78,000 sq.ft. of new floor space will be available for the manufacture of automobile seat springs.

The company has developed a new seat frame of steel and fiber which will be employed by at least two car makers in 1937 models.

Taxes Take Third Of Payroll Total

Manufacturers Group Survey Shows High Cost to Industry

Industry must pay 34 cents in taxes for every dollar its pays out in payrolls, a survey made by the National Association of Manufacturers says. Conditions in 694 companies in 25 leading industries formed the basis of the study. For each dollar paid in dividends last year, $1.42 was paid in taxes, the data showed.

Taxes in the 25 industries amounted to an average of $486 per employe. In the oil industry and its products, taxes were more than four times that much per employe. Average taxes of seven companies reporting amounted to $2,111 per employe, or 120 per cent of total payrolls.

The study showed the tax burden to be much heavier on some industries than others. The oil industry taxes were 25 per cent of sales, $945 per common stockholder, $5 per share of common stock, and 676 per cent of dividends paid.

U.S.S.R. BUYS HEAVILY

$15,000,000 of Oil Drilling and Refining Machinery Ordered in America

The Soviet Russian government is buying about $15,000,000 worth of oil field and refinery equipment from United States manufacturers, making payment in gold.

The drilling machinery is for working wells to a depth of 10,000 ft. in some cases, and the refinery equipment is of large sizes. Several years ago the Soviet government undertook to manufacture most of its oil mining and refining equipment, but due to unfamiliarity with this type of machinery, breakdowns in service occurred.

Among the companies said to have received some of the orders are Foster Wheeler Co., Also Products Co., the Lummus Co. and National Supply Co.

BUYS PLANT

Kabin Koach Trailer Co., 21813 Gratiot Avenue, East Detroit, Mich., manufacturer of coach trailers, has acquired a plant at Fraser, Mich., containing 110,000 sq.ft. of floor space where its trailers will be finished. The company will continue to operate a structural steel shop in East Detroit, Lloyd R. Worden, president, said.

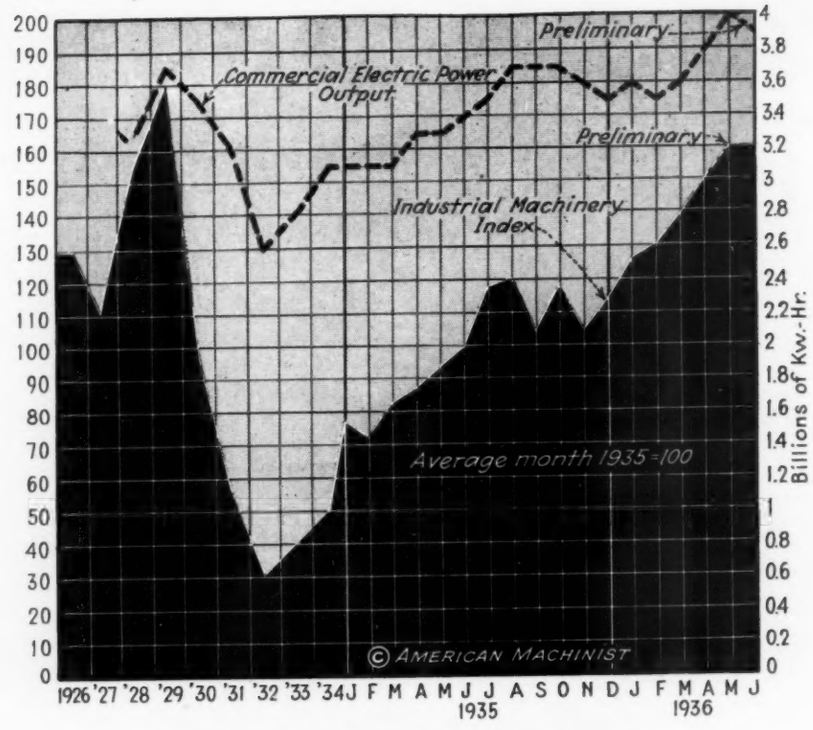
Indexes Rise Strongly

Both of the *American Machinist* indexes rose vigorously in April, for which corrected figures are now available, and will do even better in May and June according to the advance estimates. Every factor in both indexes contributed to the general improvement.

For purposes of comparison the record of commercial electric power sales is plotted against the Industrial Machinery Index. The two curves are on different bases but the general correspondence of trend is striking. Fluctuations are considerably wider in the machinery record, as might be expected.

The commercial electric sales figures are upward of 90 per cent industrial. Most of this current is supplied for power uses and a fair amount of the small balance remaining is used for industrial lighting. Less than 10 per cent goes to trade as against industry.

As compared with the preliminary estimate the final figure for April was 10 points better in the Industrial Machinery Index, while the Shop Supply Sales Index showed less than a point variation between preliminary and final figures. The upward trend started in March bids fair to continue for shop supply sales.


Preliminary
Commercial Electric Power Output
Preliminary
Industrial Machinery Index
Average month 1935=100
© AMERICAN MACHINIST
Billions of Kw.-Hr.
1926 '27 '28 '29 '30 '31 '32 '33 '34 J F M A M J J A S O N D J F M A M J
1935
1936

Orders for Industrial Machinery

How industrial machinery sales trends correspond with commercial electric output is shown; May gains are expected to be followed by continued improvement

Westinghouse Buys Relay Motor Plant

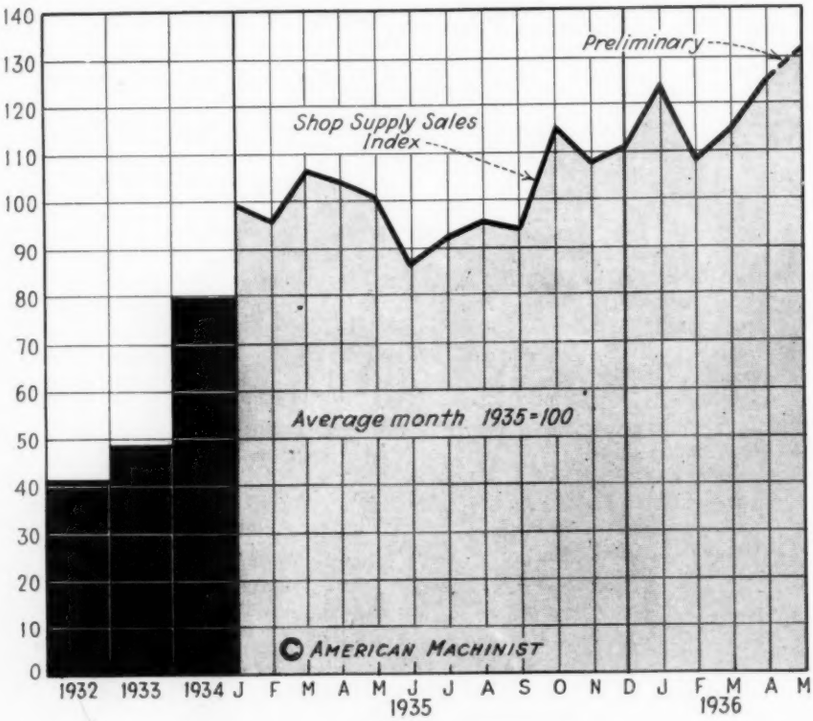
Truck Manufacturing Machinery Will Be Auctioned July 22-24

Westinghouse Electric & Mfg. Co. has bought the plant of Relay Motors Corp., Lima, Ohio, and Samuel T. Freeman & Co., Philadelphia, New York and Boston, auctioneers, will sell the 400 machine tools, other manufacturing equipment and motor truck service rights at an auction, July 22 to 24.

As soon as the sale takes place, Westinghouse will use the plant for manufacturing small electric motors, now being made at the company's Springfield, Mass., plant. The present facilities at Springfield are crowded because of increased business.

Motor production under R. F. Frenger, manager of the Westinghouse small motor division, is expected to begin by the first of next year.

The Lima buildings include about 300,000 sq.ft. of floor space. New machine tool equipment and other manufacturing facilities will be installed. The new plant will have a capacity of about 50 per cent more production.


Preliminary
Shop Supply Sales Index
Average month 1935=100
© AMERICAN MACHINIST
1932 1933 1934 J F M A M J J A S O N D J F M A M
1935
1936

Sales of Shop Supplies

May preliminary figure continues upward swing of shop equipment sales

Watching Washington

Close election is forecast... Poll gives Landon electoral lead ... U.S. funds aid party in power ... RFC cuts interest rates ... Lemke-Coughlin group plans congressional bloc ... Interpretations modify foreign tariffs

WASHINGTON—Not since 1916, when Wilson narrowly nosed out Hughes, has there been a bang-up presidential election. Harding, Coolidge and Hoover contributed one-sided victories to the Republican cause, while Roosevelt won hands down in the last contest.

But, if indications mean anything, this year will be different. Already the quadrennial crop of straw polls has begun to blossom with the prophecy that it is still anybody's race. Dr. George Gallup in his serial poll notes a sharp gain for the G.O.P. cause since the conventions. Roosevelt's popular majority, according to this straw summary, was cut four per cent, 55.8 to 51.8, since June. Landon's share includes 21 states with 272 electoral votes, a majority of 7. Offsetting this is the fact that there are more doubtful states in the Republican column, making the position of that party's nominee more vulnerable.

Candidates are just warming up to the campaign. Roosevelt has solved the Farley problem by giving his postmaster general a leave of absence without pay. Thus the Democratic strategist will have both the freedom of a private agent and the prestige of a cabinet member. Federal employees will be under no illusion as to Farley's practical politics.

Treasury Aid Is Seen

Every evidence indicates that the administration will use to the utmost its greatest source of power—that of the federal treasury. It will mail monthly railroad pension checks, although the Supreme Court of the District of Columbia recently held invalid the tax provisions of the Railroad Retirement Act which were designed to finance these payments.

The drought has served as another opportunity for political profligacy. A combination of the revived AAA and the all-embracing WPA is supplying funds to the afflicted areas at a rate calculated to make recipients truly grateful to a benevolent administration. Such action, together with President Roosevelt's planned personal appearance in the "dust bowl," may have direct influence on the political destinies of Minnesota and the Dakotas.

Congress definitely voted down the uneconomic Passamaquoddy and Florida Ship Canal projects. The President admits he has no money to carry them on but he seeks a way to make temporary use of existing plants by leasing them for a "short" period. New Dealers in Maine and Florida assure constituents that next January and a new Congress will see both projects resumed —an eventuality that probably won't come to pass regardless of the election outcome.

Interest Rate Strategy

Still another administration aid is seen in the interest rate cuts on RFC loans. Reductions up to one per cent effective from July 1 have been announced by RFC Chairman Jesse H. Jones with the "request and expectation" that borrowers will pass the lowered rates along to their debtors. This cheap money program is expected to promote recovery by giving favorable treatment "to our borrowers who still have frozen assets, and those industrial and catastrophe borrowers who are having the greatest difficulty."

And where does third-party Candidate Lemke fit into this picture? There are two theories. One is that the North Dakota Congressman expects to carry a few states but, more important, to run well enough all over to hold the balance of power in the House during the next two years. Counting all the Townsendites and Coughlinites he expects to control about 100 House votes. While that seems too high an estimate for such a bloc the fact remains that with a Congress more evenly divided between the two major parties than at present, even a smaller militant minority might exert considerable influence.

The second theory is that it is the Coughlin-Lemke objective to defeat Roosevelt this year and Landon four years hence, supplanting him with Lemke or some one else subscribing to Father Coughlin's views. Whether or not the story is true, it is believed by some important New Dealers. So we will see a drastic congressional inquiry into the financing of the third-party movement with the ardent hope on the part of the administration that it will develop that the duPonts in particular and the Liberty League in general are contributing to it.

Loopholes Galore

Preparations for enforcement of the Walsh-Healey act are giving the Labor Department some trouble. So full of loopholes is the law that Miss Perkins' aides can't make up their minds whether to be frankly vague or to particularize expecting to temporize when specific cases arise. One of the ambiguous terms in the law is "locality." This word, it is feared, may be stretched so much from its original meaning as to give the Lady Secretary power to set pevailing labor rates.

Recent developments in international trade show that tariffs are a matter of interpretation as well as law. For example, very liberal construction is currently being put on British tariff regulations to prevent any delays in the defense program. If they need a piece of machinery, customs officials certify that it is not readily procurable in the United Kingdom and a special dispensation is promptly forthcoming. And proud Britannia has formally proposed that the American and British governments undertake joint trade promotion in certain countries on a basis under which each country will furnish the portion of resulting orders that it is best qualified to supply.

For purposes of the reciprocal trade agreement Canada is assuming that an article is not made in the Dominion if production is less than ten per cent of domestic requirements.

Standard machine specifications are being translated into Spanish by the Commerce Department. Commercial attaches in South America are having the translations made there so they can be supervised, gratis, by committees of Spanish speaking engineers.

***Electrifying With Eloquence*—R. S. Elberty, appliance engineer is one of a number of Westinghouse men who gave the low-down on machine tool electrification to a group of guests at the recent forum held by this concern at East Pittsburgh. Those in attendance representing machine tool concerns included:** E. P. Bullard, F. W. Post and A. H. Platt, all of the Bullard Co.; W. F. Ridgway and G. T. Andrews, of the Ingersoll Milling Machine Co.; A. L. Krause, Brown & Sharpe Co., C. Harre and R. Lindholm, of the E. W. Bliss Co.; W. J. Guild, Heald Machine Co.; G. A. Spohn, General Machinery Co.; F. P. Healy, Van Norman Machine Tool Co.; G. McConnell, Greenlee Bros. & Co.; W. W. Betts, Barnes Drill Co.; T. A. Wettig, Acme Machine Tool Co.; J. B. Johnson, Bryant Grinder Co.; Harry Barney, Barney Machinery Co.; F. A. Fritzsch, Lodge & Shipley Machine Tool Co.; L. L. Schauer, Cincinnati Bickford Tool Co., William Retz, New Britain-Gridley Co., T. F. Eserkaln and H. Lentzner of the Kearney & Trecker Co.; S. Brandenburg, Monarch Machine Tool Co.; H. J. Griffing and C. G. Flygare of the Norton Co.; J. T. McCuen, Motch & Merryweather Machine Co.; R. E. Price, R. W. Moore, and W. S. Klay of the Landis Tool Co.; G. Davenport, Gould & Eberhardt; W. Trible, Cincinnati Milling Machine Co.; W. P. Kirk, C. A. Knowles and W. H. Hull, of the Pratt & Whitney Co.; T. E. Corbett, Firestone Tire & Rubber Co.; G. K. McKee, Avey Drilling Machine Co.; C. R. Nelson, J. Biley, H. M. Worstell, W. J. Burger and S. Lawson of the Warner & Swasey Co.; J. E. Doran, G. A. Gray Co.; E. E. Opel, National Automatic Tool Co.; C. M. Robinson, National Acme Co.; D. K. Frost, Sunstrand Machine & Tool—Mattison Machine Co.; H. N. Anderson and M. Lamprecht of the Acme Machinery Co.; G. J. LaMoth, Cincinnati Planer Co.; L. K. Voelk, Potter & Johnston Machine Co.; J. C. Hebert, K. H. Woolson, Morris Holmes and H. F. Holden of Jones & Lamson.

U. S. Patent Office Is 100 Years Old

Nation's Progress Traced By Many Revolutionary Claims Granted

Establishment of the American patent system a century ago is being commemorated this week by the officials and employees of the United States Patent Office. The anniversary took place on July 4. Because of the vital part which the patent system of the United States has played in the creation and expansion of American industries a national observance of the centenary has been suggested.

The patent system as it exists today is in its essentials that inaugurated by an act of Congress to which President Andrew Jackson gave his approval on July 4, 1836. This statute was in major part the work of Senator John Ruggles of Maine, who was himself an inventor and the recipient of the first patent granted under the new law. Prior to July 4, 1836, only 9,957 patents had been issued by the United States. Between that date and June 30, 2,046,309 mechanical patents were granted to thousands of men and women in this country and abroad.

Two of the first of the revolutionary patents which have been granted under the Code of 1836, were that to Morse for the electric telegraph and that to Goodyear for a process of vulcanizing rubber. Since these have come in the course of the years, Howe's sewing machine; Hoe's rotary printing press; Otis' elevator; Gatling's machine gun; Bullock's web press; Sholes' typewriter; Westinghouse's air brake; Hyatt's celluloid; Bell's telephone; Edison's talking machine and incandescent electric lamp; the automobile, Mergenthaler's linotype, the motion picture, the airplane, the radio, television and thousands of other inventions.

The interval between the issuance of patent No. 1 to Senator Ruggles and patent No. 1,000,000 to Francis H. Holton of Akron, Ohio, on August 8, 1911, was approximately seventy-five years. Less than twenty-four years intervened between the granting of the millionth patent in 1911 and the two millionth on April 30, 1935.

Executives Get Only 3% of Nation's Payrolls

Figures Show Salaries Are Only 6/10 of One Per Cent of Sales, and 13 Cents per Share of Stock

The popular belief that a large percentage of the nation's industrial payroll goes to a handful of top executives was shown to be false by the results of a survey made by the National Association of Manufacturers covering 694 companies in 25 leading industries.

Executive salaries, including bonuses, comprised, on the basis of this survey, but three per cent of the total payroll of American industry, six-tenths of one per cent of sales, and 13 cents for each share of common stock. Taxes, on the other hand, took 34 per cent of payrolls.

"A wholly false and misleading impression of the portion of the payroll received by top executives has been created in the minds of many Americans by the publication of the salaries of executives of certain large corporations," the Association said in commenting on the results of the study.

"Actually, executive salaries range from about one-third of the total payroll, in small businesses employing from one to twenty-five persons, to one percent of the total payroll, in large businesses employing more than 5,000 workers. For the nearly 700 companies covered by the study, the average was but three percent of the total payroll. Few people, indeed, would contend that this is a disproportionate amount for those who guide the destinies of business.

Cleveland Twist Drill Plans $500,000 Program

Expansion Involves New Building on Site of Three Old Factories

A $500,000 expansion program, to be begun at once, has been announced by the Cleveland Twist Drill Co., 1242 East 49th St., Cleveland. The company, which celebrated its 60th anniversary on June 27, will tear down the three oldest of its ten buildings and erect a five-story, fireproof structure of 106,000 sq.ft. of floor space to house several manufacturing departments and offices.

The old buildings were built by the Ingersoll Milling Machine Co., founded upon the machinery manufacturing department purchased from the partnership of Cox & Prentiss, which later became the Cleveland Twist Drill Co.

Machinery Accident Rate Rises in 1935

Severity Has Been Lower, However, Annual Safety Council Study Shows

The accident frequency rate of the machinery industry was higher during 1935, in comparison with the experience for 1934, according to reports of the National Safety Council, but the severity rate was somewhat lower.

Reports have been assembled from 241 plants whose employees worked 405,991,000 man-hours. The average 1935 accident frequency rate of 9.35 (the number of disabling injuries per million man-hours of exposure) is 13 per cent higher than the rate for 1934; and the corresponding average severity rate of 0.79 (the number of days lost per thousand man-hours of exposure) is 4 per cent lower than the 1934 rate.

The machinery industry rates compare favorably, however, with the average rates experienced in 30 major industries reporting annually to the National Safety Council, the all-industry rates being 14.02 for frequency and 1.58 for severity. The machinery industry ranks eighth among these industries in frequency and seventh in severity.

Machinery manufacturers had better experience in severity than in frequency during 1935 when compared with other industries.

The industry has been most successful in reducing severity rates over a period of years. Improvement in frequency, however, has not equalled the average reduction for all industries.

Reductions have been made in the severity for all types of disabilities since 1926. This is true also for the frequency of deaths and temporary injuries, but permanent partial disabilities have a frequency four per cent higher in 1935 than in 1926.

Small plants, as in 1934, had the worst 1935 records. The increase over 1934 in the frequency rate of the entire industry, however, is due largely to adverse experience in large plants.

MURRAY CORP. HONORED

Detroit Automotive Concern Has Lowest Accident Rate

The National Safety Council has released their annual statistics on accident rates in the automobile industry for 1935. A Detroit firm, the Murray Corp. of America, won special honor because it had a severity rate of 0.40, the lowest of any automobile factory for 1935. The Murray group includes stamping and frame plants, die construction division, engineering division and the general body building operations.

GERMAN TOOLS

Exports of Mechanics' Tools Show Rise of 30% in Volume

German exports of mechanics' tools have shown a notable upward trend during the current year, according to the U. S. Commerce Department.

Shipments from Germany in the first four months of the current year amounted to 8,392 metric tons, valued at $6,850,000 compared with 6,521 metric tons, valued at $5,800,000 in the corresponding period of 1935, a volume increase of 30 per cent and a value increase of 20 per cent.

BAEKELAND HONORED

On July 10 the Royal Society of Edinburgh, Scotland, presented Dr. Leo Hendrik Baekeland, American research chemist, with an honorary membership. He is president and founder of Bakelite Corp. The best known of his inventions is Bakelite resinoid and among his other inventions is Velox photographic paper.

PLANT EXPANDING

Holo-Krome Screw Corp., Bristol, Conn., has purchased a ten acre tract at the foot of Brook Street, Elmwood, and will proceed at once with the construction of a two-story factory 82x200 feet, and a separate heat treating building containing 300 square feet.

The new plant is expected to be ready for occupancy in September.

Industrial Review

• IN MOST of the industrial centers of the country June sales of machinery and machine tools were eminently satisfactory, and July has opened up surprisingly well. The terrific temperatures which prevailed last week had some effect in slowing down business, several shops finding that their men failed to report and others noting a distinct falling off in efficiency. Such conditions are not conducive to keen interest in equipment purchases.

• NEW ENGLAND machine tool distributors are well satisfied with early July business and look for good orders during the summer. Long deliveries are credited with stimulating the placing of orders. New York distributors report equally satisfactory sales in the Metropolitan district for June. They say also that July is opening up at almost the same level. The same cheerful report comes from Philadelphia where both orders and inquiries are well sustained. In Pittsburgh machine tool sales are holding up fairly well, the level of the last six months being maintained. Inquiries are in good volume. The impending fight between the steel operators and the labor organizers of the Lewis committee is causing considerable apprehension but the impression is that there is no real demand from the men for union organization. One mill reports that the former mine workers employed in its shops are particularly desirous of avoiding further union affiliations.

• LABOR DIFFICULTIES are plaguing the Cleveland area but even so machine tool orders are holding up rather well. The continuing skilled labor shortage is stimulating the training courses established in various plants. The hot weather has slowed up Cincinnati business somewhat but dealers and manufacturers there are reasonably well satisfied with the current summer business. The Remington-Rand strike is somewhat disturbing although it is the only evidence of the extensive undercover work which organizers are believed to be doing. In Detroit the die and tool shops are very busy which has meant better business for the machinery and tool suppliers. Some business that was not expected until fall has already been placed.

• EMPLOYMENT in Toledo manufacturing plants is practically at the same high level reached early in June. Automobile parts plants are busy getting ready for the new models of cars to be announced in the fall. In Chicago they feel that business is holding up as well as might be expected, particularly in view of the evil effects of the high temperatures. June business was the highest for the year according to several distributors. With the exception of the activities of the steel organizers labor conditions are normal. Conditions in Milwaukee are much the same as those in Chicago, experienced help is wanted and is not available. As a result equipment builders are steadily falling behind on their deliveries.

A.S.T.M. Acts on Many Standards at Meeting

200 Sessions Cover Wide Range Of Interest at Atlantic City Gathering

With a record breaking attendance of 1,131, many actions on proposed new standards and adoption of existing tentative specifications as standard, a number of outstanding sessions and intense activity on the part of Society committees, the Thirty-ninth A.S.T.M. Annual Meeting held in Atlantic City, June 20 to July 3 was outstanding.

Eighteen formal sessions were held and more than 100 technical papers and reports were presented. Thirty-one new tentative specifications were accepted for publicaton as tentative, and 76 existing tentative specifications and tests were approved for reference to Society letter ballot for formal adoption as standard. Proposed revisions in some 70 existing standards were approved at the meeting for incorporation in the standards, these to be confirmed by letter ballot of the Society members. Revisions proposed in about 38 tentative specifications were accepted and changes in ten existing standards were accepted for publication as tentative. Due to the fact that 1936 is the year when the Society publishes its triennial "Book of Standards," the standing committees were active in recommending that a large number of tentative specifications and tests which have been standing for one or more years be formally adopted as standard. The figure, 76, compares with 20 in 1935 and 60 during 1933, the previous "Book of Standards" year.

About 200 meetings of the Society committees were held. Committees reviewed existing research projects and a number of new investigations will shortly be under way. Many of the technical papers were of outstanding significance. The main features of the meeting were the symposium on Radiography and X-ray Diffraction Methods and the symposium on the Limitations of Laboratory and Service Tests in Evaluating Rubber Products.

Dr. H. C. Parmelee, editor, *Engineering and Mining Journal*, spoke on "Relationship of A.S.T.M. to Modern Developments in Chemical Engineering" at the opening session. Many synthetic and other products of recent development were described including a number of plastics and other materials such as carbon, some of which, according to Dr. Parmelee are already quite widely used in engineering applications and which may become still more widely used in the future.

Discusses Human Problems

The annual address by the president, H. S. Vassar, laboratory engineer, Public Service Electric and Gas Co., dealt with "The Testing of Non-Materials." Mr. Vassar considered "our approach to the numerous problems which have to do with satisfactory living and which so vitally concern each one of us." Among the problems he touched upon briefly were unemployment, labor, and the fomenting of hatreds.

He pointed out that "we have in this country several hundred associations of specialists in science and technology, with an aggregate membership of hundreds of thousands. In the treatment of the physical problems in their respective fields, a reasonably successful technique has been developed.

"Unless we are willing to admit the truth of the charge that we have degenerated into a nation of cynical materialists," he said, "devoid of those characteristics of our forefathers of which we boast, is there any valid reason for abandoning our methods of approach when stepping as we must, from our vocation into the non-materials field?

"It has been said that a few thousand people are sufficient at any time to change the thinking of America. If this is true, there is within the organized workers in the field of physical science a potential force fully capable of being the leaven in the meal of society, which can aid mightily in the development of a more rational approach to the problems of the day."

The Marburg lecture was delivered by Dr. Arthur L. Day, director, Geophysical Laboratory, Carnegie Institution of Washington on "Developing American Glass."

The symposium on Radiography and X-ray Diffraction Methods was one of the most extensive yet sponsored by the Society. It comprised twelve outstanding technical papers, six devoted to radiography and six to diffraction.

The 1936 award of the Dudley Medal was made to Mr. H. C. Mann, senior materials engineer, Watertown Arsenal, for his paper presented at the 1935 annual meeting on the subject "The Relation Between the Tension Static and Dynamic Tests." This paper was considered the outstanding original contribution to research in engineering materials.

A. C. Fieldner, chief engineer, experiment stations division, U. S. Bureau of Mines, Washington, D. C., succeeded H. S. Vassar as president; T. G. Delbridge, manager, Research and Development Dept., Atlantic Refining Co., Philadelphia, was chosen vice-president.

The 1937 meeting will be held June 28 to July 2 at the Waldorf-Astoria, New York.

Sixty-one Years—S. Horace Disston, vice-president and manager, Henry Disston & Sons, Inc., Philadelphia, presenting Charles M. Hoover with a check and a box of cigars in recognition of 61 years of employ by the saw manufacturing company

Vocational Guidance Given by Engineers

For the benefit of high school students wanting to study engineering, the Associated Technical Societies of Detroit recently held its first annual guidance meeting at which 123 boys and their parents were given an opportunity to consult representatives of various branches of the engineering profession about the respective opportunities.

Motors AND OTHER MATTERS

Labor horizon bodes trouble and plants decentralize . . . Materials delayed by strikes . . . Tool and die shops busy . . . New car sales keep up amazingly . . . Roomier bodies, brighter trim in prospect for 1937

BURNHAM FINNEY
Western Editor

DETROIT—In the midst of 1937 preparations, car makers are scanning the labor horizon anxiously as the United Automobile Workers of America, said to be financed to the tune of $200,000 by John L. Lewis, starts an intensive membership drive. Bulwarked by the addition of thousands of members of former rival unions which have gone over "whole-hog" to the U.A.W.A., the new international union has 22 organizers in the field. Many of them have been supplied by the Committee on Industrial Organization. Chief organizer is Richard Frankensteen, who recently led 26 locals of the Automotive Industrial Workers Association into the A. F. of L. fold. Chief adviser is Adolph Germer of the United Mine Workers.

Bait to join the union are these objectives now being dangled in front of the eyes of automobile workers: an annual wage of $2,000; a 30-hour week without reduction in the weekly wage; participation through bonus distributions in company profits; vacations with pay; "genuine" collective bargaining; control of the speed-up; and better social legislation.

Already the union claims it is largely responsible for Packard's vacations with pay and for wage increases announced by Chrysler, these measures having been taken by management to cushion the effects of the union's anticipated drive.

Directed by ex-Baptist preacher Homer Martin, the union is consolidating its forces in various automotive cities by merging plant locals into one strong union. At Flint the five locals have been welded into one local representing all five General Motors plants. This action contributes to a feeling of unity; if members in one factory have a grievance, their fellow-workers in other factories are more apt to make the grievance their own. This form of organization has been used in Toledo for several years in automotive parts plants. Committed to industrial unionism as against alignment by crafts, the U.A.W.A. is out to sign up tool and die makers as well as production workers.

While there may be "demands" on individual companies for redress against alleged grievances, the union is expected to steer relatively clear of strikes through the early fall. If it appears that strikes may hurt Mr. Roosevelt on the eve of the election, they are likely to be held in abeyance. What may happen after the election is another matter.

The industry, principally General Motors, has been moving as rapidly as possible toward decentralization as the best safeguard against effective tie-ups of production by strikes. Where parts manufacture formerly was focussed in one plant, it now is distributed among three or four widely separated factories. Cities which have been labor hot spots are being passed by. Fisher Body has moved a considerable number of operations from Cleveland to Pontiac and also is getting its new Grand Rapids plant into production. Facilities at Grand Rapids duplicate those at Cleveland. Pontiac has been free from labor strife and is being generously rewarded by General Motors with increased activities and expanded payrolls. The same is true of Saginaw. Without fanfare of publicity, Cleveland's operations will be allowed to lag. Labor worries there have long been a pain in the neck to the G.M. management. The Cleveland story parallels that of Toledo, where Chevrolet sharply curtailed work after the costly strike of April, 1935.

Car manufacturers are beset not only with their own worries, but also with the problem of keeping the flow of materials and parts uninterrupted from outside sources. The Akron tire situation troubles them no end; they are understood to have flatly told the tire companies that they must set up part of their operations outside of Akron where labor is free from the union blight. One story has it that Goodyear is to establish a factory at Jackson, Mich. Goodyear is reported to have under lease an eight-story building of Hupp Motor Car Corp. in Detroit.

Filled to the brim with orders, the local tool and die trade is running night

Getting Into Production—Two of a battery of ten universal shapers installed in the die shop of the new Fisher Body Grand Rapids Stamping division to build dies and body stampings for General Motors cars

and day without a trace of labor trouble. Many shops are so loaded with work that they cannot promise deliveries until August 15 to September 1. While big body dies are well along toward completion, much smaller work remains to be placed. Buick, Oldsmobile and Pontiac have been releasing orders; Hudson still has some die business yet to be allotted.

Altogether, the impression is growing that it will be close to show time in November before most of the new models will be unveiled to public view. One General Motors division plans to finish its 1936 run by the end of July and its assembly lines will be down practically all of August and September. It will start 1937 assemblies early in October and be ready to show its wares around November 1. This is typical of many other companies. In fact, the managements of two of the industry's most powerful companies are said to have agreed to hold off announcements until late October.

Sales Are Phenomenal

New car sales are little short of phenomenal for early summer. Chevrolet, Ford, Pontiac, Buick, Oldsmobile and Studebaker are among the companies which smashed records in June. Ford's sales, at 108,379 units, were the highest of the year. The Rouge plant is back on a five-day week. July output for the industry should be around for the industry should be around 400,000 units, raising the total for the first seven months of 1936 to about 3,000,000 units. This compares with 2,723,227 units in the same period a year ago.

Olds has had a six and eight this year which look alike. So has Pontiac. The result has been that sales of eights have suffered severely. Olds is taking steps to correct the situation by having the styling of its six differ from that of its eight in 1937. Car interiors will be roomier. More stainless steel will be used to "doll up" the new models.

All major equipment buying programs for the start of 1937 work have been cleaned up. Machine tool orders probably will lag until September, when car makers begin to make purchases to increase output after the intial run is well under way.

EXPANDS FACTORY

American Forging & Socket Co., Pontiac, Mich., manufacturers of automobile body hardware, will spend about $150,000 for additions to its plant. Later, a new power plant will be built, as part of a three-year program.

Employment and Wage Trends Continue Up

Conference Board Shows Slight Gains In May, Substantial Increases Compared With Last Year

Employment and earnings in manufacturing industries showed further improvement in May, the regular monthly survey of the National Industrial Conference Board shows, with slight gains in man-hours worked, amounts of payrolls and hours of work.

Average hourly earnings in the 25 industries covered by the survey advanced from 61.2 cents in April to 61.4 cents in May. Average weekly earnings rose from $23.78 to $24.08, or 1.3 per cent. Employment increased 0.7 per cent; man hours, 1.2 per cent; payrolls, 1.9 per cent, and hours of work, 0.5 per cent.

Substantial increases in man-hours in the metal-working industries, including machinery and machine tool manufacturing, automotive, electrical equipment and foundry equipment were shown. Textile industries and boot and shoe manufacturers showed employment declines.

Improvement in the labor situation in May, 1936, as compared with May, 1935, was indicated by an increase of 6.1 per cent in employment; 2.7 per cent in hourly earnings; 10.8 per cent in weekly earnings; 8.5 per cent in purchasing power or real weekly earnings; 14 per cent in man-hours and 17.5 per cent in payrolls in the 25 industries reporting.

DOUBLES CAPACITY

Jackson Company Expands There and at New Brunswick, N. J.

Ryerson-Haynes Co., Jackson, Mich., maker of automotive parts, has acquired a plant in Jackson formerly used by the Watts-Morehouse Co., thereby doubling its manufacturing capacity.

It also has taken over a plant at New Brunswick, N. J., where it will make automotive products as well as a new toy camera. The company now builds tire covers, fender shields and auto jacks.

OFFERS SPEED REDUCER

Dominion Engineering Announces Line of "Cone" Gear Units

A standard line of speed reducers featuring the use of "Cone" worm gears with their 30-times larger contact area and high load carrying capacity, has been announced by Dominion Engineering Co., Ltd., Montreal, Canada. Units range from four to 18 in. in center distances and are available in all types such as horizontal or vertical shafts, worm on bottom or top, and combination worm gear units for high ratios of reduction.

U. S. Buys Tractors, Grading Machinery

Caterpillar Tractor Gets Half of Huge Forestry Order

Orders totaling $2,798,009 were placed with road building machinery and tractor, truck and power shovel companies last week by the U. S. Forest service. Caterpillar Tractor Co., Peoria, Ill., was awarded contracts for 169 tractors and 145 graders, to cost $1,262,691. International Harvester Co. was given an order for 127 tractors, and Cleveland Tractor Co. will build 79 units.

Four-Wheel Drive Co., Clintonville, Wis., will supply 86 heavy duty trucks, and Fargo (Dodge Bros.) will ship 316 lighter trucks. Smaller orders went to General Motors Corp., Allis-Chalmers Co., Lima Locomotive Works, General Excavator Co., Harnischfeger Corp., and other manufacturers of power shovels and drag lines to be used on Civilian Conservation Corps projects.

TO BUILD AEROPLANES

Stearman-Hammond Will Erect Plant at San Francisco

Stearman-Hammond Aircraft Corp., recently organized, has selected a site near the San Francisco municipal airport and will begin manufacturing a "fool-proof" airplane, such as was selected last year by the Department of Commerce in a contest. Capacity for the first year will be eight airplanes a month, with ultimate capacity of fifteen units.

Officers of the company, the first to announce manufacturing in the San Francisco Bay area, are Lloyd Stearman, Deal B. Hammond and Samuel Metzger.

LEASES MORE SPACE

Emerson Electric Increases Manufacturing Facilities in St. Louis

To provide for additional manufacturing facilities Emerson Electric Co., St. Louis, has leased 43,000 sq.ft. in one nearby building, and 34,000 sq.ft. in another building for the company's offices, now located in the main building. This space also will be turned over to manufacturing. The new address will be Nineteenth and Washington Aves.

HUPP HEAD DIES

Wallace Zwiener Was Recently Elected President of Hupmobile

Wallace Zwiener, president of the Hupp Motor Car Corp., Detroit, since May 13 and identified with the automotive industry in Detroit since 1916, died July 7.

Mr. Zwiener was elected treasurer of the company in November, 1934, after many years of experience in the automotive industry. He was a member of the Chevrolet official group in 1916, and from 1917 to 1921 was assistant general controller of that company.

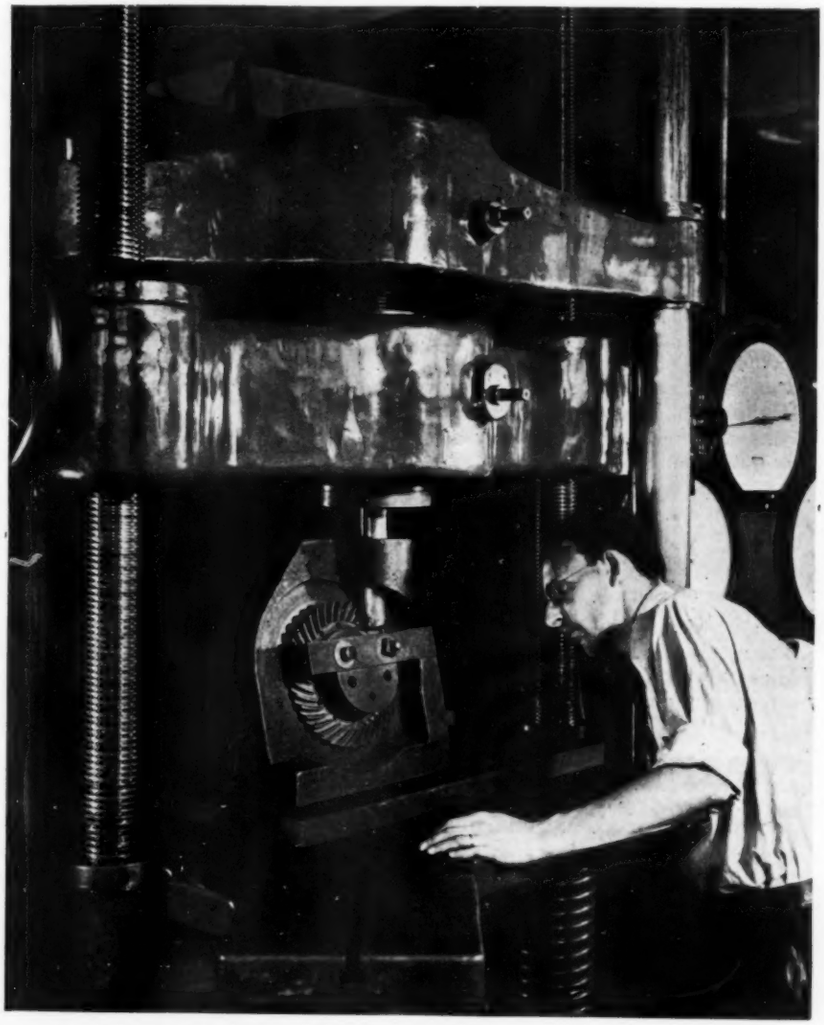
From 1921 to 1930 he was chief controller of Durant Motors, Inc. In 1930 he took the position of controller of Continental Motors Corp., holding that position until he was appointed treasurer of Hupp Motor Car Corp.

PERSONALS

DR. GIOVANNI P. CASIRAGHI, formerly chief, structural department, Waco Aircraft Co., Troy, Ohio, has been appointed chief engineer of Piaggio & C., Finale Ligure, Italy. He was identified with several aircraft makers in this country as manufacturing executive.

CHARLES W. FRANCE has been elected vice-president and general manager of the Curtiss-Wright Airplane Corp., Robertson, Mo. He will be in charge of manufacturing at the St. Louis plant of the company.

JOSEPH HAMMOND has been appointed superintendent of the new transmission plant of the Buick Motor Co., Flint, Mich. He will continue also to supervise the motor plant.



Breaking Off Teeth—**Extractor, with 100,000-lb. thrust, in testing laboratory of Chevrolet gear and axle plant, Detroit. Gear is placed in the jig and plunger, bearing on gear tooth, is loaded until tooth breaks off. Test is constant check on quality of alloy steel used**

GEORGE L. SEXTON has organized the Long Hill Laboratories, Long Hill, Conn., which will manufacture parts and specialties for the automotive industry. He was recently vice-president and general manager of the Bond Electric Co.

LEWIS P. KALB has been appointed vice-president in charge of manufacturing and engineering for Continental Motors Corp. Last year Mr. Kalb was a vice-president of the Society of Automotive Engineers.

S. W. OSTRANDER has been named shop superintendent of the Pontiac Motor Co., Pontiac, Mich. He will be succeeded as chief master mechanic by BERT CONWAY, who was at one time the master mechanic of the transmission plant of the Chevrolet Motor Co. at Toledo, Ohio, and recently has been connected with Pontiac.

FRED L. RIGGIN has been appointed president of Mueller Brass Co., Port Huron, Mich., manufacturers of brass and copper products, succeeding O. B. MUELLER, resigned. He joined the company 32 years ago when it was established in Decatur, Ill.

DEAN HERMAN SCHNEIDER, University of Cincinnati, was awarded the Lamme medal for engineering achievement at Madison, Wis., June 25, by DR. E. B. ROBERTS, manager, technical employment and training, Westinghouse Electric & Mfg. Co. The award was founded by BENJAMIN G. LAMME, late chief engineer of Westinghouse.

FRANK M. SMITH, formerly vice-president, Stout Motor Car Co., Dearborn, Mich., has been appointed assistant to the president of American Coach & Body Co., Cleveland, manufacturers of buses.

COMMANDER ELLIS STONE, U.S.N., has been assigned to duty at the Bethlehem Ship Building Co., Quincy, Mass., in connection with fitting out the heavy cruiser U.S.S. Vincennes.

RALPH K. SUPER is the new chief engineer of Linderman Devices, Inc., Detroit. He has been in charge of development and application of brake equipment for the Mack International Motor Co. for the last six years.

PAUL E. TAMPLIN has been named assistant superintendent of the National Malleable & Steel Castings Co., Sharon, Pa., works.

FRANK J. WOOD has been appointed chief engineer of the industrial manufacturing division of Goodman Mfg. Co., Chicago, Ill. He was formerly with the Mesta Machine Co.

BUSINESS ITEMS

R. G. Haskins Co., 4630 Fulton St., Chicago, has appointed George G. Pragst exclusive distributor of the company's line of high speed tapping machines in the New England states.

General Refractories Co., Philadelphia, has moved its general offices to the Real Estate Trust Building, Broad and Market Sts.

American Electric Furnace Co., 27 Von Hillern St., Boston, has appointed Earl E. Wright, Chattanooga, its representative for eastern Tennessee. A. D. Heath, 1701 North Illinois St., Indianapolis, succeeds Thomson Tool & Supply Co. as Indiana representative, and Clyde J. Boeringer, 7412 Race St., Pittsburgh, will represent the company in western Pennsylvania and West Virginia.

Michigan Products Corp., Michigan City, Ind., manufacturers of stainless and heat resistant alloy steel castings, has named C. Q. Swenson its representative for Michigan, with offices at 2842 West Grand Blvd., Detroit.

Lincoln Electric Co. has appointed Intermountain Belting & Packing Co., Denver, 1414 Wazee St., Denver, its Colorado, a part of Kansas, Nebraska and Wyoming agent.

Cutler-Hammer, Inc., Milwaukee, has moved its Los Angeles quarters to 1331 Santa Fe Ave.

Cold Metal Products Co., Youngstown, Pa., is purchasing new tools and manufacturing equipment to rehabilitate its plant following a recent fire.

Bryant Machinery & Engineering Co., 400 West Madison St., Chicago, has appointed Cleveland Duplex Machinery Co., West 3rd St. and Lakeside Ave., Cleveland, general distributor for products manufactured by Boye & Emmes Machine Tool Co., lathes; Cleereman Machine Tool Co., drilling machines; Dresses Machine Tool Co., radial drills and monitor lathes; Kling Bros., heat duty grinders; Ohio Machine Tool Co., shapers, planers, horizontal boring, drilling and milling machines.

OBITUARIES

F. Coleman Boyd, president of the Faraday Co., New Haven, Conn., manufacturer of electrical appliances, died July 5.

Arthur Bradyn, chief master mechanic of the Buick Motor Co., Flint, Mich., died July 4.

John J. Carroll, 74, president, Gartland & Carroll Co., Sandusky, Ohio, foundry and machinery works, died June 26.

Frank Ennis, production manager of Baird Machine Co., Stratford, Conn., died recently in Bridgeport. He was well known in the machine tool industry.

George W. Feaser, 70, for many years manufacturing executive and lately superintendent of the Oliver Chilled Plow Works, South Bend, Ind., died June 30.

Wilton M. Grant, 49, vice-president, Hoyt-Grant Co., New Haven, Conn., machinery and powerplant specialists, died June 28.

Willard H. Jerolamon, 67, proprietor of the Jerolamon Boat & Machinery Works, near Long Branch, N. J., died June 30.

Samuel J. Miller, 80, Norwalk, Conn., head of the Gilbert & Bennett Mfg. Co., Georgetown, Conn., wire manufacturers, died July 8 following an illness of three days.

Carl W. Nielsen, 38, mechanical engineer with the Farrel-Birmingham Co., Ansonia, Conn., died July 4.

W. J. Ormsby, master mechanic of the Illinois Central Railroad, Freeport, Ill., died suddenly June 26 in Chicago.

Albertis C. Taylor, 59, vice-president and general manager, Taylor Winfield Co., Warren, Ohio, manufacturer of electric welding machinery, died June 30.

Elwood W. Webb, 42, manager of the S. O. C. Co., Ansonia, Conn., died June 24. He had been associated with the screw manufacturing company for a number of years.

T. W. Williams, 82, vice-president, Bissell Sweeper Co., Grand Rapids, Mich., died suddenly July 6 while vacationing in Sea Girt, N. J.

MEETINGS

Dairy & Ice Cream Machinery Manufacturers Association. Oct. 12-17, Atlantic City, N. J. Roberts Everett, vice-president, 232 Madison Ave., New York.

Great Lakes Exposition, July, August and September, Cleveland, Lincoln G. Dickey, manager, Terminal Tower, Cleveland.

Industrial Relations, Nineteenth Annual Conference. Aug. 19-22. Silver Bay, N. Y. E. C. Worman, executive secretary, 347 Madison Ave., New York.

National Metal Show. 18th Annual Exposition. Oct. 19-23, Lakeside Exposition Hall, Cleveland. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

National Safety Council, Inc. 25th Congress and Exposition, Oct. 5-9, Atlantic City, N. J.

Society of Automotive Engineers, Inc., Aircraft Production Meeting, Oct. 15, 16 and 17, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 West 39th St., New Work.

EXPORT OPPORTUNITIES

Tools, garage equipment and automobile parts. (Agency.) Mosul, Iraq. *1064.

Small tools; breast drills, braces, bits, drills, hacksaws, planes, levels, screwdrivers. (Agency.) Sydney, Australia. *1039.

Bakery machinery; dough dividing, weighing. (Purchase.) Pamplona, Spain. *1043.

Fruit packing machinery; grading, wrapping and other packing equipment. (Agency.) Buenos Aires, Aregntina. *1044.

Glassware manufacturing machinery. (Purchase.) Mexico City, F.D., Mexico. *1045.

Ice-making machinery, 1,000 tons daily capacity. (Purchase and Agency.) Paris, France. *1069.

Garage and automobile repair tools and equipment. (Agency.) Calcutta, India. *1108.

Tools, carpenters' and mechanics'. (Agency.) Toronto, Canada. *1077.

Glove manufacturing machinery. (Purchase and Agency.) Prague, Czechoslovakia. *1101.

Knitting machines, circular, for rayon fabrics. (Purchase.) Dublin, Ireland. *1100.

Label-wiring machinery. (Purchase.) Toronto, Canada. *1087.

Oil mill machinery, complete. (Purchase.) San Jose, Costa Rica. *1088.

Refrigeration equipment, absorption. (Purchase.) Paris, France. *1089.

Machinery for making roofing, tiles and ceramics. (Purchase.) Buenos Aires, Argentina. *1106.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office. Please refer to key number.

American Machinist REFERENCE BOOK SHEET ©

Metal-Cutting Bandsaws

Published through courtesy of Henry Disston & Sons, Inc.

There are several reasons why metal cutting bandsaws are used instead of circular saws and hacksaw blades:

1. A metal cutting bandsaw cuts a smaller kerf than either a circular saw or a hacksaw blade.

2. Metal cutting bandsaws can cut curves.

3. A finer tooth space is possible with metal cutting bandsaws than with either circular saws or power hacksaw blades.

4. It is possible to cut a wide range of sizes and shapes of material on a metal cutting bandsaw machine; that is, much wider than is possible with a circular saw or hacksaw.

5. Generally speaking, the material to be cut is hand fed and in a great many instances this is the only way the material can be cut.

Metal cutting bandsaws are made in the following types:

1. With blades hardened on the toothed edge only, called "hard-edge flexible-back" saws.

2. With blades hardened throughout, called "spring-tempered" saws.

Hard-edge saws are accurate cutting tools and are not punched, but milled, and then set in a machine which is extremely accurate. All teeth are equal in size, equal in shape and the set of each tooth is the same as the set on every other tooth. Thus, the work is distributed equally over all the teeth. Hard-edge saw teeth can never be reset. Sometimes they are resharpened once or twice by grinding, but it is not recommended. Such saws are recommended for cutting the harder materials and they usually operate at a low peripheral speed.

Spring-tempered saws on the other hand operate at high peripheral speed and are not accurate cutting tools.

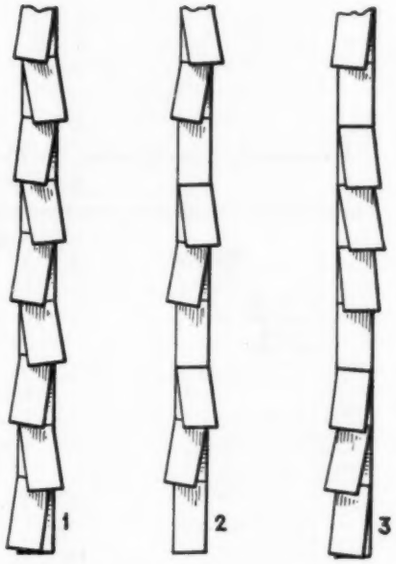


Fig. 1 — Straight-tooth set. Fig. 2 — Raker-tooth set. Fig. 3—Group set

There is no need to mill the teeth and so they are punched. Spring-tempered metal cutting bandsaws are recommended for cutting the softer materials in thin gages, and they can be resharpened.

The "set" of the teeth is important. "Straight set," that is, "*S*" set has one tooth set to the right, and the next to the left as shown in Fig. 1. The "raker set," that is, the "*R*" set, has one tooth straight (the straight tooth is the raker tooth to act as a cleaner and a chip breaker), one tooth to the left next tooth to the right, as in Fig. 2. The "group set" shown in Fig. 3 and known as "*G*" set has one set of waves to the right and the next set to the left to give the smallest possible tooth spacing.

The gage of a saw depends upon the diameter of the wheel, because the diameter determines the radius of the bend the saw must make during each revolution. Gages for standard wheels are:

Size of Wheel, In.	Gage of Saw	Widths, In.
12	25	⅛—½
15	23	⅛—½
18	23	⅛—½
20	23	⅛—½
24	21	⅛—¾
30	21	⅛—¾
36	21	⅛—¾
36	20	1 —

There are two factors which determine the width of a metal cutting bandsaw:

1. The greater the feed the wider and heavier must be the saw to stand it. It is impractical to give a table of widths and feeds because of the wide range of operating conditions and the long list of materials to be cut.

2. The smaller the radius of the curvature to be cut, the narrower the saw must be.

Width of Bandsaw, In.	Minimum Radius That Can Be Cut, In.
⅛	¾
¼	1½
⅜	2¼
½	3
⅝	4½
¾	8
1	

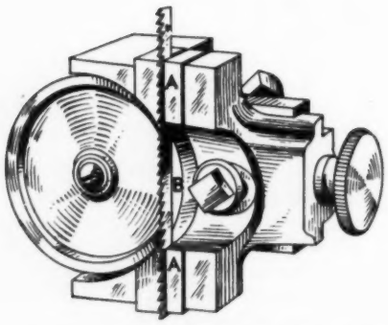
Saws must be tensioned over the wheels and each machine has a tension adjustment. The following table gives the tension in pounds for the different width blades:

Width of Blade, In.	Tension or Strain, Lb
⅛	55
¼	100
⅜	160
½	200
⅝	240
¾	320
1	

To obtain full cutting efficiency of a bandsaw blade, careful attention should be given to proper adjustment of the guide rolls:

1. (a) Place the saw on the wheels of the bandsaw machine with the teeth projecting slightly over the edge (or over the recess which is cut in the flange

Metal-Cutting Bandsaws



At A is the way teeth should project outside of guide block, while B shows how the back edge of saw should rest against the wheel

of the bandsaw wheels on some machines).

(b) The saw should be adjusted in the guides so that the teeth project outside of the guide blocks.

2. (a) After the saw is properly adjusted on the wheel and top guide, see that the bottom guide is in proper alignment with the top guide.

(b) Where rolls are used for guides they should be so adjusted as to hold the blade in proper alignment for straight cutting.

(c) If guide plates are used in place of rolls, adjust them to permit the saw to pass through freely without binding.

(d) Bear in mind that the primary function of the guide is to support the blade.

(e) Bandsaws should be removed from the machine or tension released when not in use. This is particularly true during winter months when there are extreme changes in temperature.

Recommended Specifications for Cutting Specific Materials with "Hard-Edge" Metal-Cutting Bandsaws

Material	*No. Teeth Per Inch	Set	Temper	*Speed of Blade, Ft. Per Minute
Aluminum alloy (pistons, moulding)	12–14	R	B	100–150
Aluminum pure	8–10	S	B	1000–3000
Aluminum sheets	8–10	S	C	1000–3000
Asbestos sheets (thin gauges, transite, asbestos board, etc.)	8–12	S	A	150–200
Babbitt	10–14	R	B	1000–1500
Bakelite	8–10	S	A	800–1000
Brass cast, soft (screw stock, red-yellow brass, etc.)	10–14	S	B	700–1500
Brass cast, hard	10–14	R	A	200–500
Brass sheets and tubing	14	S or G	C	700–1500
Bronze (manganese, tobin, etc.)	10–14	R	A	150–350
Bronze castings	10–14	S or R	B	300–800
Bronze moulding	14–18	S	B	500–1000
Builders board	8–12	S	A	150–200
Carbon tool steel	12–14	R	A	100–150
Cast iron	12–14	R	A	100–150
Cold rolled steel	10–12	R	B	150–200
Copper	8–12	S	C	500–1000
Drill rod	14	R	A	80–150
Everbright (nickel, copper alloy)	10–12	R	A	150–350
Everdur	10–12	R	A	150–350
Fibre	8–10	S	A	300–500
High-speed steel	12–14	R	A	90–125
Hose—canvas and rubber	8–10	G	C	1000–2000
Hose—metallic	18–22	G	C	500–1000
Iron bars	12–14	R	B	100–150
Iron sheets	14–18	R	B	100–250
KA 2S (Nirosta, ascoloy, etc.	12–14	R	A	90–100
Machinery steel	10–14	R	B	100–150
Malleable iron	12–14	R	A	150–200
Metal wood	14	R	B	1000–2000
Mica	10–12	S	A	300–600
Monel metal	10–12	R	A	125–200
Nickel silver	18–22	S	B	150–175
Nickel steel	12–14	R	A	90–125
Pipe	14–18	R or S	B	100–200
Radiator core	14–18	R or G	B	150–400
Rubber—hard	10–14	S	A	150–200
Slate	10–14	S	A	100–150
Structural steel	10–14	R or G	B	90–150
**Thin moulding and special shapes	10–12	R or G	C	10000 & 11000
Transite	10	R	A	100–200
Tubing—steel	14–18	R or G	B	100–150

*Generally speaking, the greater the number of teeth the lower the speed and vise versa. Operating conditions vary too widely to make all these recommendations without variations. Actual operating experience on specific machines gives the only correct answer.

**Special for sections under 20 gauge where flexible saw is preferred over spring temper.

Ideas FROM PRACTICAL MEN

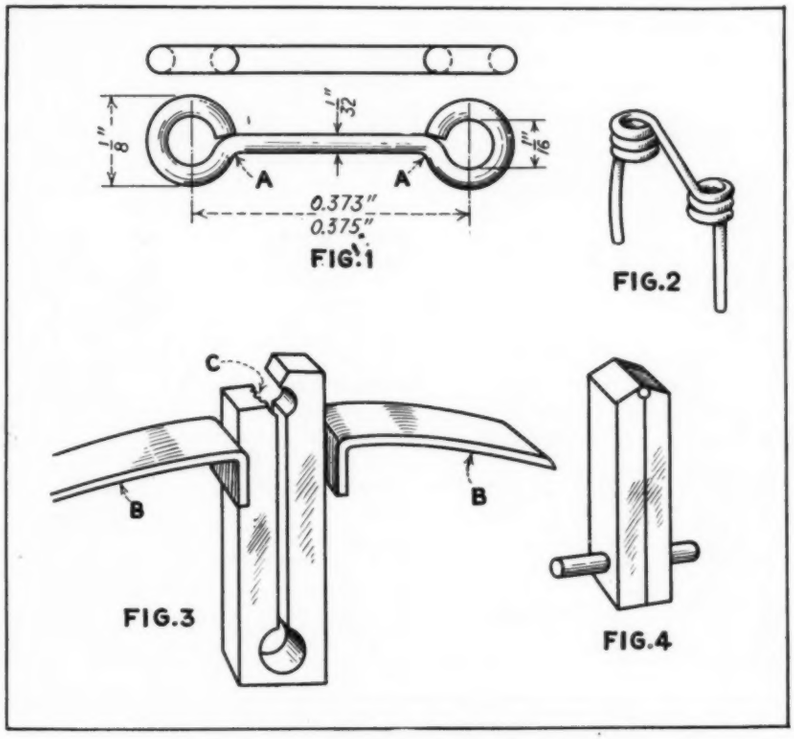
One Link of Music Wire

CHARLES WESLOW

There are plenty of good toolmakers who would become puzzled were they given a job making one music spring wire link as shown in Fig. 1.

The first move is to find out what size arbor is needed that will produce a spring of three or four coils to the exact diameter; the arbor must be made of drill rod, hardened, with the temper drawn so it will not break during the winding. The next move is to find out how close the two springs should be (Fig. 2) so that when they are bent in the fixture in Fig. 3, they will come between 0.373 and 0.375 in. A gage is needed to find this distance. When the springs are ready to be bent as at *A* Fig. 1, one spring of three or four coils is placed into the fixture, made of B. & S. ground tool steel, and squeezed in the vise so that the coils will become imbedded into the jaw as at *C*, Fig. 3. Then the jaws of the fixture are hardened, but the corners of the threads must be filed off, otherwise the music wire may break while bending. The bending is done with a screw driver.

The next move is to remove the surplus coils with a chisel, one at a time, until there remains just enough to file, and that amount is just enough so that exactly one coil will remain. Then the two coils are flattened with pliers and straightened. The jaws in Fig. 3 can hold three or four coils securely, but not merely one coil, and the threads at *C* are to keep the coils from slipping while being bent as at *A*.



A little job can take a lot of time particularly when a hard-to-handle material like music wire is used

At *B* are two pieces of ⅛ in. cold-rolled steel placed in the vise jaws so that only the upper ends of the fixture jaws will close in on the coils. The arbor must be placed in the coils when clamping in the fixture jaws.

The fixture in Fig. 4, is for holding the link while the ends of the coils are being filed. It is clamped on the straight part of the link with small parallel clamps.

It took me eight hours to rig up, experiment, and make just one link. I made over a dozen before I made one to dimensions. A good foreman never gives such a job to a young toolmaker and sometimes not to an older man because they lack experience. I learned such work in the mechanical laboratory of Francis H. Richards in New York City, in the year 1906, under a foreman by the name of Crowell who learned his trade in Hartford, Conn.

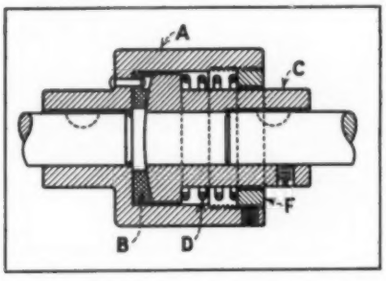
Friction Coupling for Light Drives

JOHN A. HONEGGER

For light drives where fractional horsepower motors are used, the friction coupling illustrated is a safety device to prevent machines from being driven beyond the danger point.

The coupling consists of the outer member *A;* the concave asbestos washer *B;* the inner member *C;* the spring *D;* and the threaded adjusting collar *F*. The concave washer is riveted to the inner end of member *A* and the inner end of member *C* is turned convex to fit it. Contact between the concave washer and the convex end of member *C* is maintained by pressure of the spring. It will thus be seen that the amount of torque transmitted from one member to the other is determined by the pressure exerted by the spring, which can be varied by screwing the adjusting collar in or out.

A feature of this type of coupling is its ability to adjust itself to slight misalignments of the shafts.



The torque delivered by this friction coupling is dependent upon the friction between the concave washer and the convex end of the inner member

Fixture With Simple Clamp

F. SERVER

In Fig. 1 is illustrated a fixture for holding a forged steel trip lever while a slot is being milled through the center of the lug at one end.

The work, indicated by heavy dotted lines, is slotted by the cutter *A*, which revolves in the direction of the arrow, so that the thrust of the heavy cut forces the lug down on the stop *B* on both sides of the cut. The work is located endwise by the shoulder *C*, while the opposite end is located for height by the adjustable stop *D*. It is located sidewise by the shoulder *F* and the pin *H*. The clamp *I* slides in a hole in the fixture and the clamping screw *K* passes through a clearance hole in the clamp, being threaded into the fixture.

Two crossholes are provided in the head of the clamping screw for the lever *L*, so that if the screw should become worn, the lever can be put in the extra hole to prevent it from interfering with the cutter arbor. Details of the clamp and the holding block are shown in Fig. 2. The bottom *M* of the clamp rests on a flat surface in the base to prevent it from turning with the screw and also to keep the screw from springing as the work is clamped. The upper view shows the clamping block and how it is cut away at *N* for cutter clearance. The round part of the clamp is a sliding fit in the hole *O*. Like parts in both figures are indicated by the same reference letters.

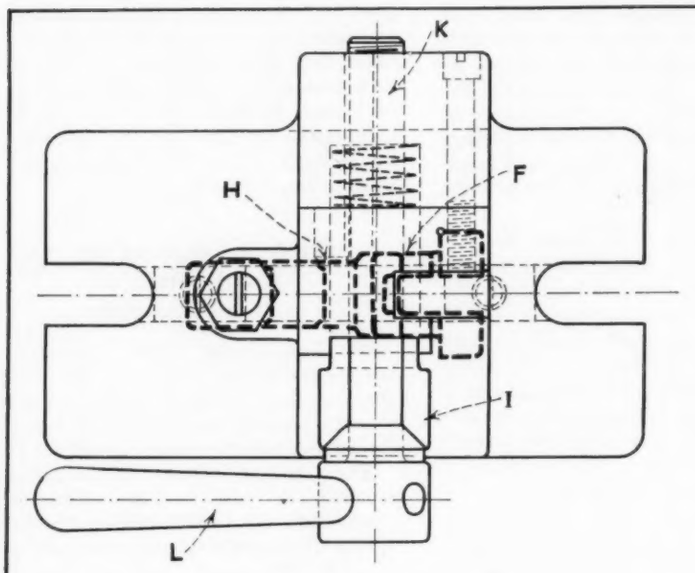
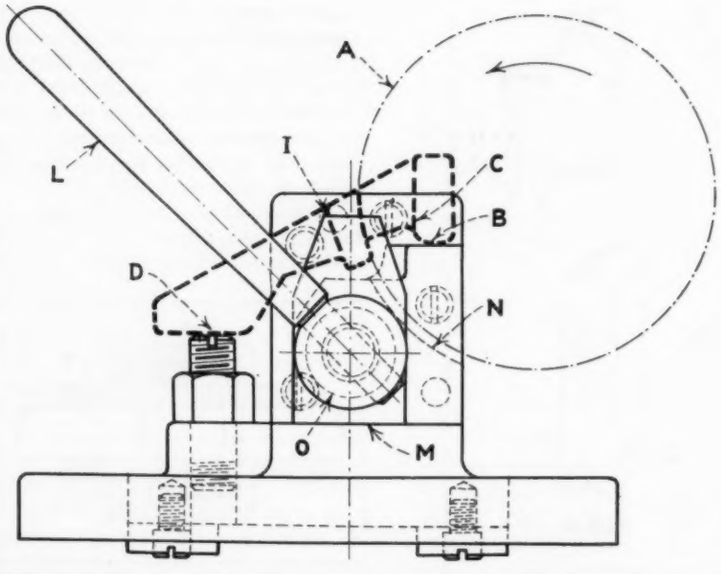


FIG.1



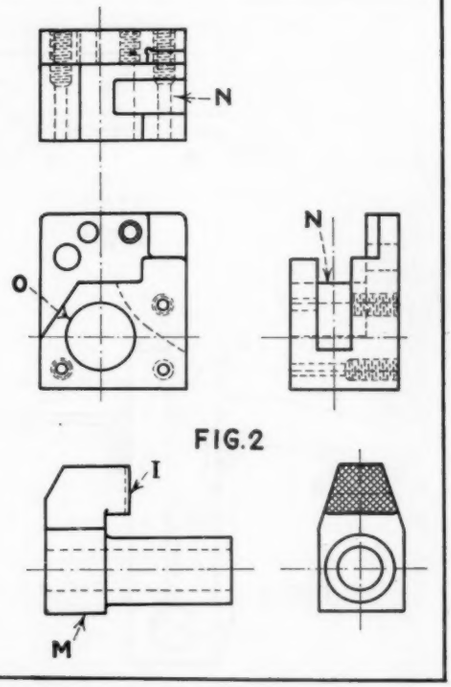


FIG.2

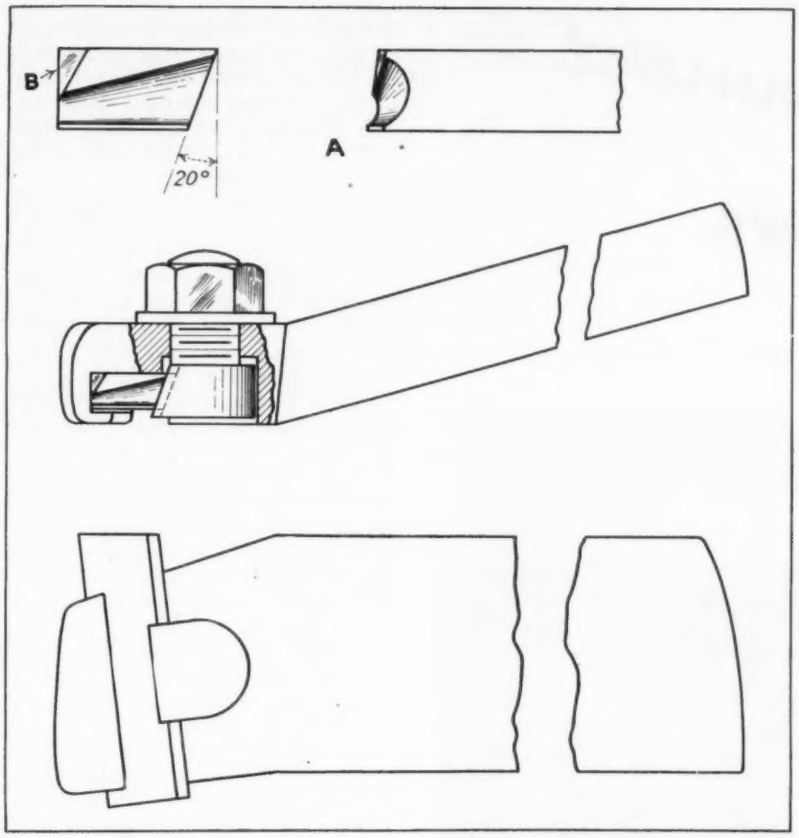
Convenient Gage for Setting Thread Tools

O. D. BRADSHAW
St. John, New Brunswick.

Referring to the article by J. E. Moore under the title given above (*AM*—Vol. 80, page 349), the gage illustrated would be very handy on work other than precision threading and threading tapered work where the tailstock is set over.

For precision threading the tool would have to be accurately adjusted for height, for which the gage referred to makes no provision. For threading tapered work where the tailstock is set over, the tool should be set at a right angle to the center line of the work and not at a right angle to the taper surface, which latter would be the case if the tool were set to the groove in the tailstock center.

Fig. 1—The work is located in the fixture by adjustable stops and fixed shoulders. The thrust of the heavy cut keeps the work in contact with solid stop. Fig. 2—Details of the clamp and the clamping block. Like parts of these members are indicated by the same reference letters in both figures



After toolbits used in box tools in screw machines become too short for further use, they can be used for lathe work by holding them in a holder such as this

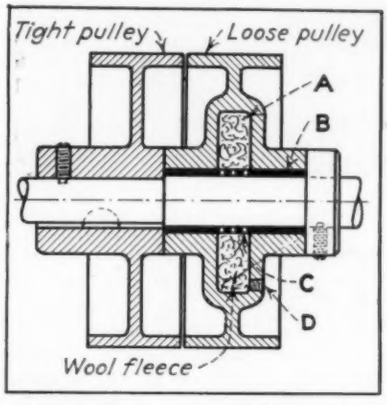
Holder for Short Toolbits

OCTAVE ANTONIO

After the toolbits used in box tools in our automatic screw machines have become too short for further use, they are used in the lathe by holding them in a holder such as the one illustrated. Thus, for the majority of our lathe work the tool bits cost us nothing but their scrap value.

Toolbits held endwise instead of flatwise are more efficient. Due to the way they are ground, the chips are sheared from the work with less resistance and are neatly coiled. Heavier cuts can be taken before chatter and excessive spring occurs.

Tool bits presented to the work endwise can be sharpened with very little grinding. The toolbit at *A* illustrates the grinding. It will be noticed that the heel is backed off at *B* and that the back is ground at an angle of 20 deg. to suit the clamp in the holder. The toolbit is set in the holder so that it is tipped slightly in the direction of the cut, thus providing correct cutting clearance. Any screw machine operator knows how to grind such toolbits and it will pay the latheman to learn.



The chamber in the pulley is filled with wool fleece and oil and the oil gradually seeps out on the shaft through the holes in the bushing

Automatic Oiling Device for Loose Pulleys

J. R. WHITTLES

The loose pulley on a countershaft can be automatically oiled by making it as shown in the illustration. The chamber *A* is cored and is filled with wool fleece. The bronze bushing *B* is driven in the bore of the pulley, a series of small holes having been drilled in it to come opposite the chamber, as at *C*. A hole *D* is drilled and tapped for a pipe plug and is used either for filling the chamber with oil or for draining dirty oil from it when necessary.

When the chamber is filled with oil, the wool fleece soaks it up by capillary attraction and delivers it gradually to the countershaft through the holes *D* in the bushing.

Outboard Bearing Support

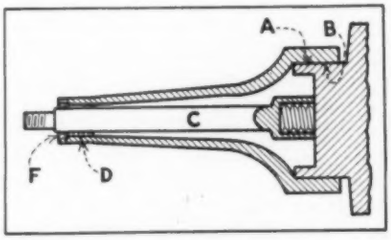
JAMES L. GUTHRIE
Honolulu, Hawaii

In machining some large brake drums, we found so many hard spots that the tool would spring away and leave them out of round, so we had to resort to grinding. Our only equipment was a toolpost grinder, but it had no support for the outer end of the necessary extension spindle.

To overcome the difficulty we made the support illustrated. The inner end *A* is bored to fit snugly on the wheel-guard seat *B* of the grinder. The outer end extends to the shoulder on the extension spindle *C*. The bronze bushing *D* serves as a bearing and is protected from abrasive dust by the felt washer *F*, which is let into a bronze ring screwed into the end of the support.

With this grinder we are finishing the brake drums mirror smooth and within 0.0005 in. of round at an average rate of 20 min. each, including roughing. We use a 4x¼x½-in. carborundum wheel, grade T, grain 36 for roughing and grain 80 for finishing. The grinder is set at an angle so that the support will not interfere with the work, the face of the wheel being dressed to the same angle.

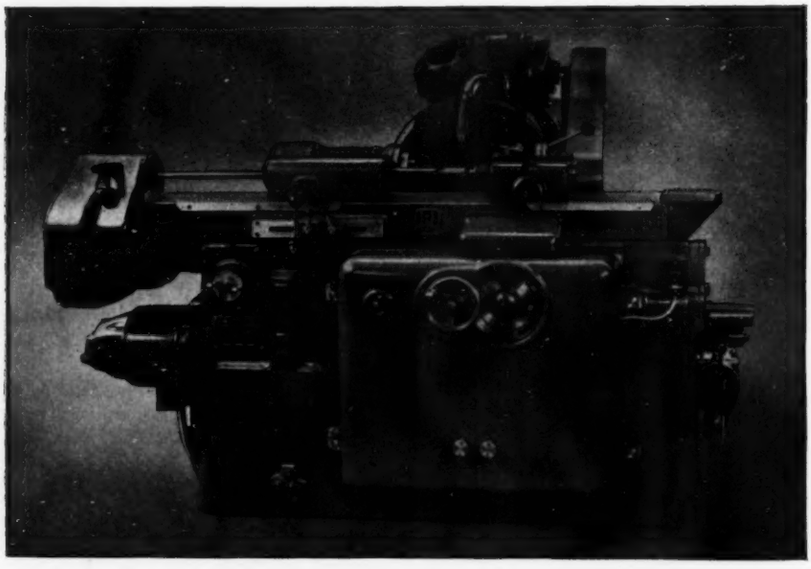
While the grinder equipped with this device is not a production tool, it will be very useful for many small shops and maintenance units that do not feel warranted in spending much money.



The inner end is bored for a snug fit on the wheel-guard seat of the toolpost grinder. The outer end carries a bronze bushing that is protected from abrasive dust by a felt washer

Shop Equipment NEWS

J & L Automatic Thread Grinder



The Jones & Lamson Machine Co., Springfield, Vt., has designed an automatic thread grinder with a self-truing, self-sizing mechanism. The truing device is considered the primary element of the machine. With no attention from the operator and without disturbing the size adjustment to which the wheel is continually set, the wheel is kept sharp throughout its effective life. In consequence, metal is removed by a true cutting action in the form of microscopic chips instead of dust, and as a further consequence, a high rate of metal removal without burning the work is secured, and heavy cuts can be taken without sacrificing accuracy.

This grinder is fully automatic except for putting the work in and taking it out, and withdrawing the wheel at the end of the cut. The standard machine is designed to grind up to and including threads 8 in. in diameter and up to and including a maximum thread length of 9 in. This length of threading may be ground on any part of work 24 in. long. The standard machine is made to swing work of 11½ in. maximum diameter, with a maximum work length of 31 in. between centers. The machine spindle is bored 1⅛ in. in diameter to permit grinding threads up to 1⅝ in. in diameter on long work such as shafts when held in a chuck. Further, the machine will grind single, double, triple, quadruple, or sextuple threads within its range. The machine will grind from the solid or from previously roughed threads.

A rheostat is graduated to correspond with the wheel-truing device so that, as the wheel decreases in size, the rheostat may be changed to maintain the proper peripheral speed. The machine is equipped with a single-lever, work-speed selector. Use of a direct-reading dial facilitates the choosing of the right work speed. Eighteen speeds, forward and reverse, may be used when grinding in either direction. However, when grinding in one direction a choice of 75 to 100 r.p.m. for the rapid return movement is available.

A cradle supports the grinding wheel spindle and motor to permit tilting the wheel to any angle up to 15 deg. either way, to correspond with the angle on the thread being ground. Another feature is the taper grinding attachment. By inserting a hardened steel former of the desired taper, the machine will reproduce this taper on the work without compensation for lead. Whatever the shape of the former, be it taper, combination of straight and taper, or double taper, this shape will be reproduced. A standard maximum of 1½ in. of taper may be ground on any portion, or over the entire length of 9 in.

A standard attachment is furnished for grinding circular chasers, button-type thread hobs, or thread hobs without lead. This device feeds the wheel to depth, then backs it out of the cut. The work is advanced equal to the pitch, then the wheel is fed again into depth. This action is repeated automatically until the work is completed. This attachment also permits grinding straight or taper hobs without lead and with either straight or spiral flutes.

For relieving taps and hobs, an attachment is furnished with the necessary change gears to furnish any amount of relief desired. On taps it is possible to grind any portion of the lands concentric before the relief starts.

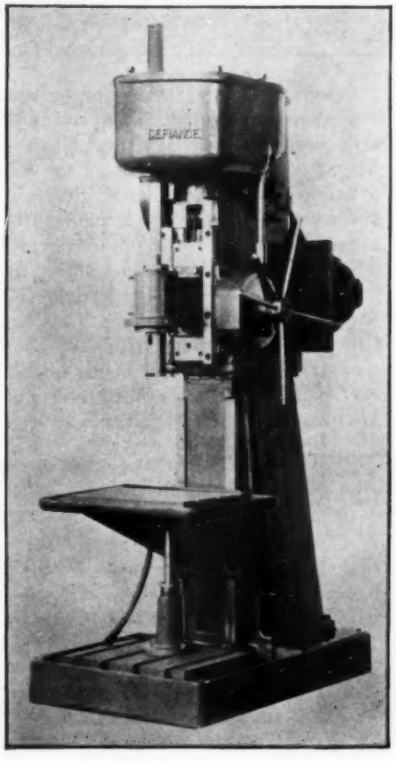
Westinghouse Type CR Induction Motor

Especially designed for heavy industrial duty, the Type CR single-phase, repulsion-start induction motor announced by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has high starting and pull-in torques. It is available in ratings from ¾ to 3 hp., 110/220 volts, and comes up to speed in a very short period of time. At approximately 60 per cent of synchronous speed the armature is short circuited and the motor continues to operate as a squirrel-cage type.

Defiance No. 200 Production Drill

An upright drill for continuous operation in production lines and designed as a single purpose machine, yet having the flexibility of a general-purpose machine, has been developed by The Defiance Machine Works, Defiance, Ohio. This No. 200 production drill allows a change in feed or speed by transposition of gears when changes in product or material become necessary. The gears are part of the machine and any one of twelve speeds and sixteen feeds is quickly available. No expense is thus involved in ordering or fitting new gears and there are no complicated speed or feed mechanisms in the machine.

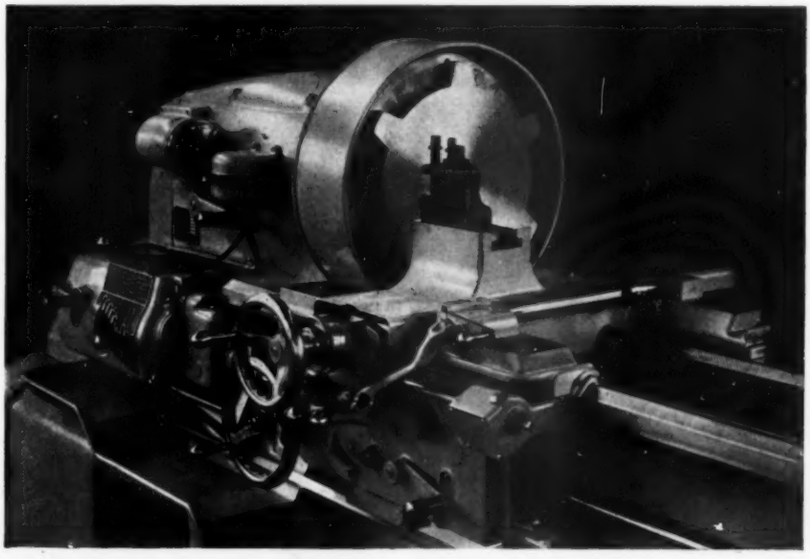
The drive is transmitted from the drive shaft to the spindle drive sleeve. Shaft and sleeve are mounted vertically in large ball bearings and have their upper ends multiple splined to receive the speed gear train. The speed gears are interchangeable on the vertical sleeve and shaft to make possible a closely graded range of twelve spindle speeds. A similar arrangement of gears with splined holes made to fit interchangeably on the upper ends of four vertical splined shafts comprise the feed train. These gears give a selection of sixteen closely graded feeds from 0.006 to 0.037 in. per rev.



Multiple-spindle heads may be attached to the lower side of the spindle bearing housing by means of a flange or lugs on the head, or they may be made so as to bolt onto the slide. In this case a multiple-splined shaft would serve to drive the head instead of the standard spindle. The table is furnished with either a jack screw or a set of pedestal blocks for vertical adjustment. One set of five blocks provides 15 in. of vertical adjustment with variations of 1 in.

Specifications: Capacity of high speed drill in steel, 2 in.; distance center of spindle to column face, 13¼ in.; spindle travel, 12½ in.; number of spindle positions on slide, 3; maximum distance spindle nose to top of table, 39 in.; working surface of table, 18 to 24 in.; vertical adjustment of table by jack screw, 18 in.; weight, 4,700 lb.

Monarch Hydraulic Multi-Speed Lathe



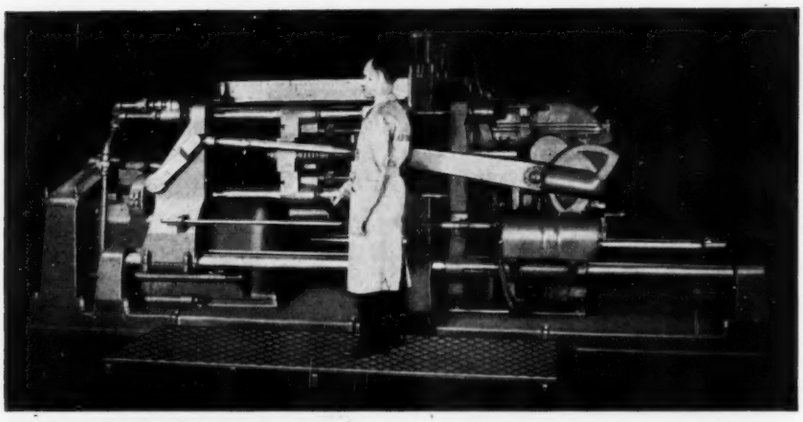
A tachometer showing spindle r.p.m. and an automatic spindle speed control are fitted to this Monarch 18 in. Model BB lathe equipped with a 20-hp. hydraulic multi-speed drive and magnetic chuck. This lathe is used for facing clutch plates and maintains a constant surface cutting speed on all diameters.

In addition to the Timkenized helical-geared-head lathes, the Monarch Machine Tool Co., Sidney, Ohio, now has available a hydraulic multi-speed drive for all sizes of lathes where it should be used. These drives are furnished in 5-, 10-, 15 and 20-hp. sizes, and provide any desirable range of spindle speeds. Both toolroom and production lathes can be fitted with the drive.

A specially constructed headstock leg houses the hydraulic variable speed transmission. Drive from the transmission is by multiple V-belt to an anti-friction sheave, multiple splined to the spindle. Where a slower range of spindle speeds is desired, a helical back-geared unit is installed in the headstock, two gears being placed on the spindle and two on the backshaft.

With the exception of the headstock and headstock cabinet leg unit, the hydraulic multi-speed lathe is the regular standard machine, and every attachment and accessory which can be furnished on similar sizes on Model C toolroom lathes and engine lathes can also be furnished on the hydraulic multi-speed lathe.

It is said that the multi-speed lathe should be used under these circumstances: (1) On all lathes used on facing work; (2) On lathes where multiple diameters are turned or bored, where a saving in time will be made by automatically changing spindle speeds in order to maintain the desired surface cutting speed on all diameters; (3) On engine lathes and toolroom lathes where a wide variety of diameters are being turned, bored, or faced; (4) On lathes where it is desired to secure maximum production and long tool life by using the exact spindle speed required, and (5) On lathes where it is desirable to have a slow speed range through back gears for heavy roughing cuts and a high speed range for carbide tools.



A solid lock for the movable die carriage is provided by four air cylinders and wedges

Madison-Kipp No. 8 Automatic Die-Casting Machine

What is probably the largest automatic die-casting machine ever built is announced by the Madison-Kipp Corporation, Madison, Wis. This No. 8 machine is built for large casting work where the pressure areas are apt to be very great. Therefore the cross head is equipped with four air cylinders to which wedges are attached so that when the machine is in the closed position these wedges will drop over the four movable die carriage guide rods to provide a solid lock for the movable die carriage. This machine is also equipped with standard locking bars, the air-actuated wedges being required only for exceptionally large castings. The size of the machine is 22½ in. by 28½ in.

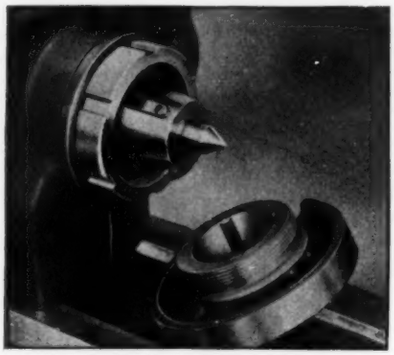
Alloys of zinc, aluminum, lead or tin are handled by the No. 8 automatic. Effective capacity of the gooseneck is 25 lb. in zinc alloy. Metal pot capacity is 1,200 lb. of the same material. Standard operating speeds are 5 shots per min., 3.33 shots per min., 2½ shots per min., and 1.66 shots per min.

Core-pulling devices can be applied. The combination bars on which the core-pulling cams are mounted may be placed at various positions on top of the machine and two or more of these combination bars can be used at one time. The reciprocating action, which opens and closes the dies, and which automatically provide the proper dwell period for shooting the casting, is accomplished through a patented dwell crank cam unit. Such units are also standard equipment on other and smaller models of Madison-Kipp automatic die casting machines. The length of the machine is 204 in., the width 72 in. and the height 82 in., while the weight is 30,000 lb.

Le Blond Tapered and Keyed Spindle Nose

Rapid, accurate and positive placement of lathe chucks, face plates and fixtures are secured on Le Blond lathes by the adoption of a new taper and keyed spindle nose. The R. K. Le Blond Machine Tool Co., Cincinnati, says that this construction provides absolute safety for today's high speed.

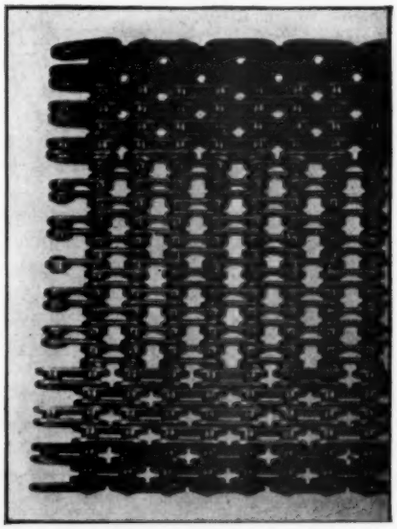
With the threaded-type spindle nose, it is said that the stopping of the machine backs off the chucks and faceplates from the threads. Although the flange-type spindle overcomes this objection, it is difficult and expensive to build and changing time is too great.



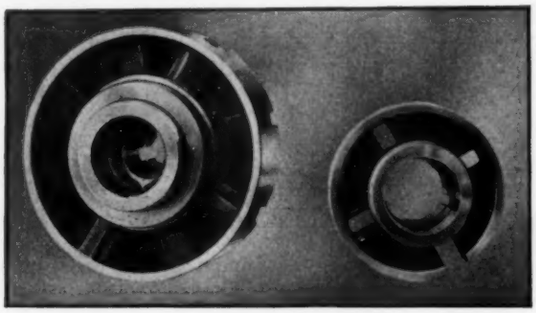
The key in the spindle brings the thread in the collar with that on the faceplate or chuck into alignment immediately, so that the collar engages the chuck or plate without jockeying

With the new spindle nose the operation of changing chucks is simply and quickly accomplished. The key in the spindle permits plates or chucks to be hung on the spindle, allowing the operator to use both hands to start and to tighten the collar. To take off or to put on a faceplate or chuck requires 12 to 15 sec. The top of the key takes all the wear of the sliding chuck or plate and the loose fit of the thread in the collar and on the chuck or faceplate allows quick attachment and holds securely without binding. Only three sizes of chuck and faceplates are required with the new taper nose for all sizes of Le Blond lathes from 12 to 36 in.

Whitney Metallic Belt Conveyor



Open-mesh conveyor chains for conveying parts to furnaces and ovens are now built by The Whitney Chain & Mfg. Co., Hartford, Conn. They offer a maximum of smooth flat conveying surfaces. Each chain is made from standard units to the desired width. The open-mesh construction allows free circulation of air when required. The silent chain center driving links and the wide-face driving sprocket eliminate tooth interference. Unit bushing and link design gives maximum joint bearing surface and resistance to wear.



The hole in chuck or faceplate, as well as the new spindle bearing, is easily and quickly cleaned

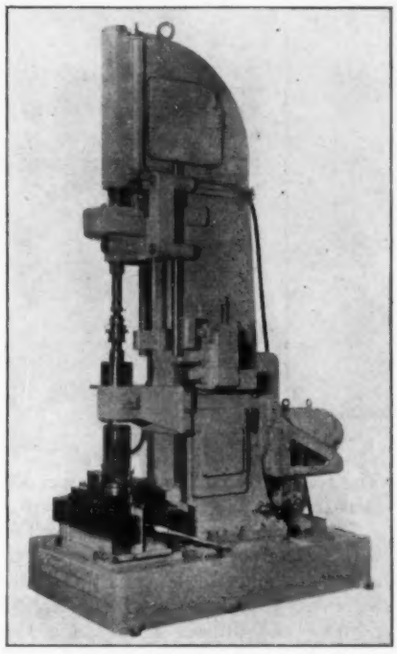
Barnes No. 2610 Vertical Honer

All cylinders from 3 to 10 in. in diameter can be taken on the No. 2610 full hydraulic honing machine announced by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. The machine has a variable-speed hydraulic transmission for the spindle rotation and provides any speed between 100 and 250 r.p.m. A tachometer on the reciprocating head indicates at all times just what speed is being used. Standard spindle travel is 20 in., and the machine will swing 26 in., but greater travel can be supplied at reasonable extra cost.

No sliding head is used, but rather a traveling anti-friction-bearing spindle carriage. The ball bearings run directly on hardened and ground vertical shafts serving as a permanent durable track.

The illustration shows the right side of the machine and also the air counterbalance paralleling the inclosed hydraulic cylinder at the top and directly connecting to the reciprocating or vertically traveling carriage. The upper horizontal lever at the control station is used for short stroking to remove taper or high spots. The lower horizontal lever controls the skip stop for lift out.

Specifications: height of machine 11 ft. 7 in.; distance, center of spindle to face of column, 13¼ in.; maximum distance from top of table to nose of spindle, 56½ in.; spindle stroke, 1 to 20 in.; table surface, 17x30 in.; floor space, 47x75 in.; weight with 10-hp. motor, 7,050 lb.



Barnes No. 2610 vertical honing machine set up with a "Micromatic" automatic hone for a tractor sleeve 5¾ in. bore by 15 in. long. The work is held on the flange end under the collar and the clamps shown

Oilgear 300-Ton Vertical Press

Variable capacity from 60 to 300 tons can be obtained from a two-column vertical press developed by the Oilgear Co., 1403 West Bruce St., Milwaukee, Wis., because the automatic unloading control is adjustable. Pressing and return speeds are also variable to suit the operation. The stroke of the press, also adjustable, is 8 in.; the daylight 26 in.; the approach speed, 195 in. per min.; the pressing speed, 15 in. per min., and the return speed, 260 ft. per min. The width between the guides, right to left is 24 in., and the base, front to back, is 30 in.

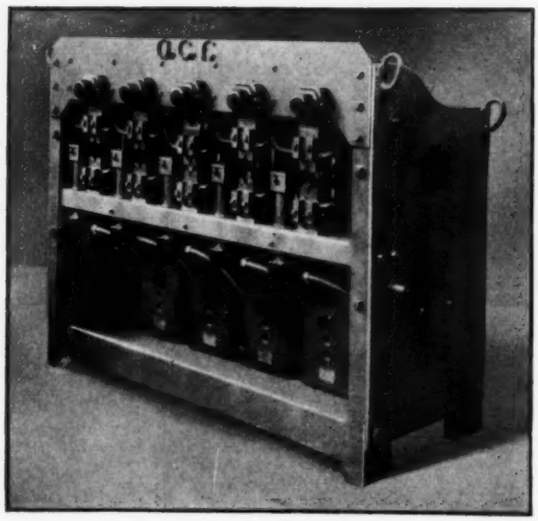
The main press structure is welded. Two double-acting, rapid-traverse cylinders, one attached on each side of the cross-head, are concealed in the press frame. Fluid-power operation is provided by an Oilgear pump direct-connected to a 20-hp. motor.

Niagara Series BL Power Squaring Shears

Series BL power squaring shears with capacities of 10 to 12 gage, and built in 8-, 10- and 12-ft. cutting lengths, are announced by the Niagara Machine & Tool Works, Buffalo, N. Y. These shears are of the underdrive design. The crosshead is operated by connecting rods running directly from the eccentrics to the crosshead, thus relieving the housings of tension stresses. The webbed beds are keyed and bolted to the housings to maintain positive alignment. Rigid triangular-section steel crosshead resists torsional stresses in all directions and maintains alignment of the knife. An adjustable truss rod provides support for the center of the knife.

Sheets can be cut accurately to a line because the cutting line is clearly visible from the front of the shear between the pressure feet as well as from a position vertically above the cutting edge as observed through an adequate opening between the holddown and the rearwardly sloping front web of the crosshead. Bulletin 71-F gives complete information on the shear.

A hold-down with individual spring-pressure feet grips long or short sheets firmly



Slugs are slid into the V-block jaws and heated to the exact temperature which is under control of a photo-cell tube

"a.c.f. Berwick" Electric Metal Slug Heater

Electric eyes and an automatic kicking-out device are applied to the "a.c.f. Berwick" electric metal slug heater announced by the American Car & Foundry Co., 30 Church St., New York, N. Y. It is only necessary for the operator to insert the piece which will then be heated and removed from the heater at the exact temperature required. All adjustments are easily and quickly made, and it is impossible, it is claimed, for an operator to overheat or underheat the pieces. The jaws on this heater have a vertical movement.

Sheffield Adjustable Plug Gages

Twenty-three different standard sizes of plug gages to provide a complete range covering a minimum of 2½ in. to a maximum of 12½ in. are announced by the Sheffield Gage Corporation, Dayton, Ohio. Fig. 1 shows a type furnished in variety of sizes up to 4 in. while Fig. 2 covers the remaining sizes. These gages are convenient in size and possess a fine crackle finish. The frame itself is made of a specially heat-treated and seasoned alloy iron.

The gage may be furnished either with button or pin-type anvils. Diameter of each gage is quickly adjusted within its complete range. The lock is positive and utilizes a flat on a lock bushing, which, by screw adjustment, binds against a straight flat on the anvil, eliminating distortion.

"Metal-Bord"

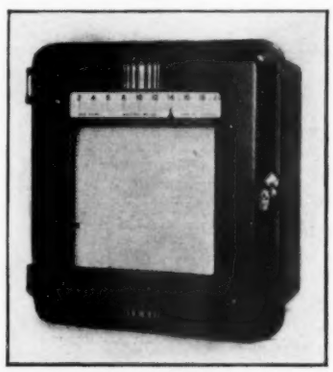
By adhering thin sheets of pre-finished metal to cardboard or other backing material a composite item lower in cost and in weight is available from the American Nickeloid Co., Peru, Ill., under the trade name "Metal-Bord." Any thickness of metal can be used and composited to about any type and thickness of backing. The material can be fabricated by shallow stamping and parts will undergo moderate forming. Of course, the thickness of the material itself prevents it being formed to any great extent. In blanking and shearing both operations involve cutting which is easily accomplished. The denser type backings, such as press board, will give the cleanest shearing job. Blanking should be done with the metal side up and the edge will be straight.

Metal-Bord can be supplied in a bright, satin, alternating bright and satin stripe, crimped or corrugated finishes. It is suitable for advertising specialties, display stands, ornaments.

"Micromax" Recorder

Not only are all combinations of indexing, recording, signaling and controlling combined in one instrument, but in the "Silver Anniversary Micromax" recorder these functions are measured in a convenient manner. A bold scale and pointer show the condition at the moment, and a clear record on 10 in. of strip-chart shows it for the past several hours. On controllers, a second pointer shows control setting. The Micromax recorder is manufactured by the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

In this Micromax, control and signal contacts operate undisturbed by air currents when the door is opened and when the chart is changed or the pen refilled. The pen holds a seven-weeks' ink supply. All parts of the mechanism are readily accessible because of the double frame and the user may replace the chart without effect on the other parts of the recorder.



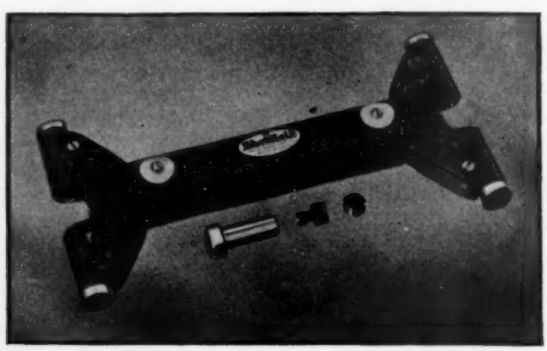
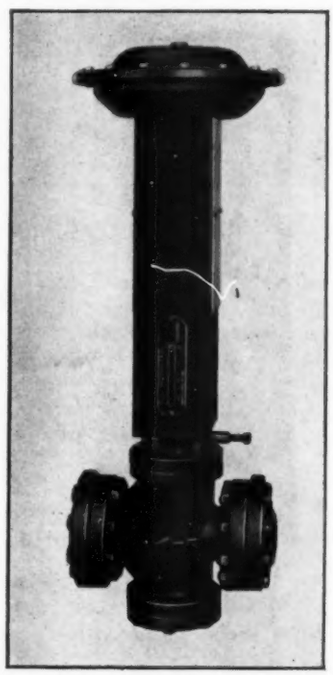


Fig. 1, at left—Sheffield gage made in sizes to 4 in. Fig. 2, at right—Style for sizes from 4 to 12½ in.

Taylor "Motosteel Evenaction" Valves

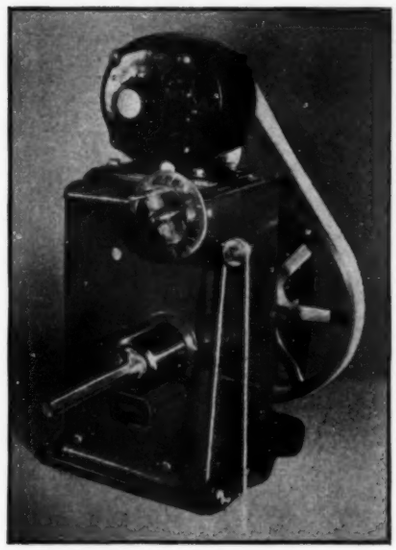
All-steel welded construction is used for the completely redesigned line of "Motosteel" diaphragm valve motors put out by the Taylor Instrument Companies, Rochester, N. Y. With this construction the valves are lighter in weight, stronger, and have greater resistance to shock than the cast-iron type. A larger molded diaphragm in the valve motor has formed impressions in the top plate to provide freer access of air pressure in starting, thus insuring a greater effective initial force. A longer and larger spring gives greater initial compression. A free-rolling action for the stem guide is assured throughout the entire stroke.

Spring and spring-adjusting nut, as well as other moving parts, are fully enclosed, yet are readily accessible for adjustment or maintenance by removing the side plates. Valve-position indicator establishes the valve opening. All parts are treated to prevent corrosion.



"Laminated" Arbor Spacers

The Laminated Shim Co., Long Island City, N. Y., is now marketing arbor spacers packed ten to an envelope or twenty to an envelope in eight different thicknesses from 0.001 to 0.020 in., and in six sizes. The waterproof envelope prevents damaging and wasting of thin spacers in handling, both in the stockroom and in the shop.



Sunnen Precision Honing Machine

A precision bench honing machine for grinding, honing and lapping holes in all metals, except lead or babbitt, has been developed in improved form by the Sunnen Products Co., 7900 Manchester, St. Louis, Mo. It is said that no particular skill is required to operate and hold the work within limits of 0.0001 in. The machine will handle any hole from 0.480 to 2.4000 in. in diameter which has no keyway and which is not more than 7 in. in length. Duplication of size is maintained by the micrometer stop graduated in 0.0001 in.

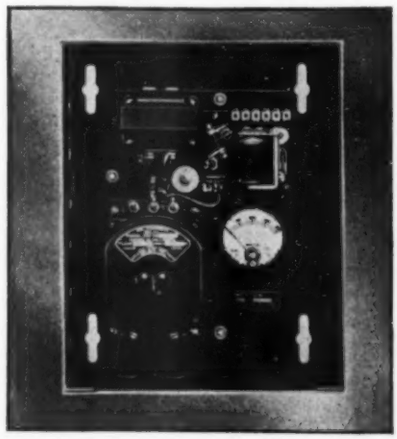
Mandrel revolution and stone feed-up are controlled by a pedal, allowing the work to be removed from the mandrel instantly when the pedal is released. When the work is put back on the mandrel, the grinding unit is brought back to duplicate position by exerting pressure on the pedal. The plane and position of the rough hole are maintained. No shifting or crowding over is possible because of the full length and diameter contact of the hole. The honing machine is suited for many operations.

Hobart Electrodes for Light-Gage Sheets

Thinweld, specially coated electrodes for arc welding of light-gage sheet metal are offered in $\frac{1}{16}$, $\frac{5}{64}$ and $\frac{1}{8}$ in. sizes by the Hobart Co., Troy, Ohio. Among the light welding applications of these electrodes are fabrication of sheets such as used in auto body and fender work and in heating and air-conditioning cabinets and ducts. It is said that some operators have successfully arc welded metal as light as 24 and even 26 gage.

Weston Model 729 Photo-Electric Unit

It is said by the Weston Electrical Instrument Corporation, Newark, N. J., that its Model 729 photo-electric control unit has double the usual sensitivity and operating speed. The assembly consists of a Weston photo-cell of high output characteristic in a protective mounting, a complete relay unit in a separate panel box, and a light source of standard design. Output capacity is 500 watts, so that most installations can be handled directly by the relay contacts without the use of external contactors. The relay is arranged for single-pole, double-throw operation, with an over-all speed of response of 0.15 sec. Positive action of the relay at speeds up to 400 operations per min. permits automatic control of high-speed processes.



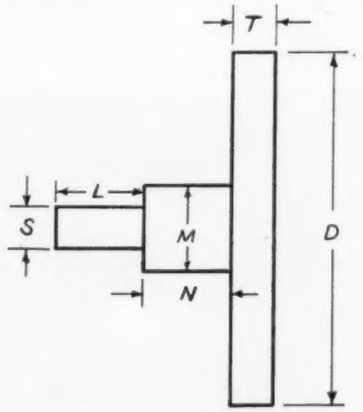
Ideal Electric Marker

A portable electric tool that fits the hand is being marketed by the Ideal Commutator Dresser Company, 1439 Park Ave., Sycamore, Ill., for marking on practically any material irrespective of whether it is a metal or a non-conductor of electricity. The tool is supplied with a special point. This unit writes like a pencil, is $6\frac{3}{4}$ in. over-all.

Mann Diamond Laps

Permanently charged diamond laps for working hard materials, including carbide tools, are now available from the Mann Instrument Co., 10 Arrow St., Cambridge, Mass. These laps run true about the shoulders *S* and *M* and the face only is charged. The dimensions have been chosen to cover a wide range of uses. The three smallest sizes can be clamped in the collets of the average watch lathe, the others in bench lathe chucks or collets.

Two sizes of diamond grit are used in charging these laps. The coarser is intended for quite rapid cutting, while a much finer abrasive is used for fine grinding or finishing. Use water as a lubricant or cutting fluid.

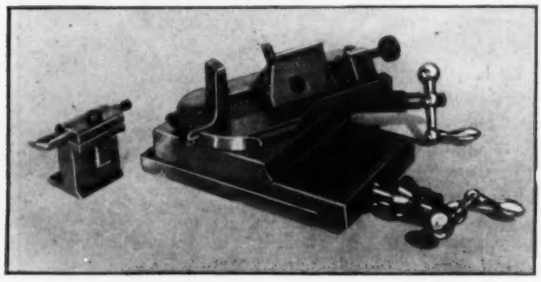


D	*M*	*N*	*S*	*L*	*T*	Speed
½″	3/16″	3/8″	..	..	3/16″	5,000
1″	3/8″	½″	3/16″	½″	¼″	4,500
2″	½″	½″	3/16″	3/4″	3/16″	4,000
4″	⅝″	1″	½″	1″	½″	2,000

Wade Radius Turning Attachment

For application to bench lathes, The Wade Tool Co., Waltham, Mass., has designed a radius turning attachment to machine spherical surfaces either concave or convex on the axis of the lathe and to machine half-round grooves (concave), or half-round collars (convex) on the surface of a cylinder rotated on the axis of the lathe.

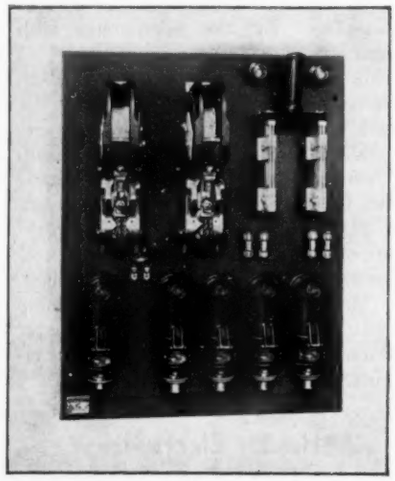
Two interchangeable toolholders and a set block are furnished. The toolholder illustrated in position is required to turn annular grooves or collars because its shape avoids interference with the bar. The other toolholder is for turning spherical surfaces, concave or convex, on the end of the bar. The set block is easily placed in position when setting a tool, and then removed. Advancing the tool beyond center produces a concave surface and withdrawing from the center produces a convex surface. The tool is for use with lathes having swings from 8 to 8½ in., and its capacity is from 0 to 4 in. diameter.



"E. C. & M." Crane Control

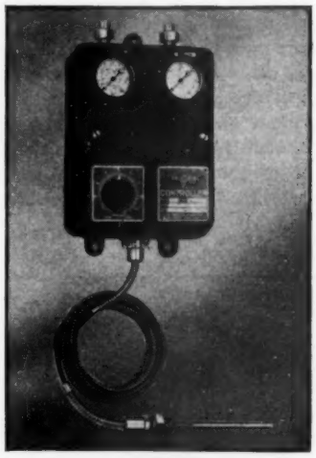
To protect electrical equipment used on cranes, the Electric Controller & Mfg. Co., 2721 East 79th St., Cleveland, Ohio, announces a complete line of crane protective panels. These are used in place of circuit breakers, knife switches and fuses, and incorporate all of the necessary protective devices into a single, compact unit, requiring a minimum amount of space.

Protective panels are built open, or they can be completely inclosed or front inclosed. In all three styles, the main line knife switch is arranged for padlocking in the open position to prevent operation of the crane during idle periods or when repairs or adjustments to the crane are desired.



Bristol Model 90 Pneumatic-Type Controller

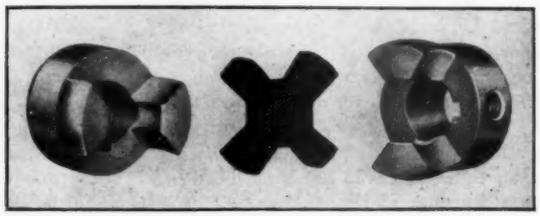
Many requirements for automatic temperature and pressure controls do not warrant a chart record or it may be that recording instruments are already in use. For such applications, the Bristol Co., Waterbury, Conn., has developed the Model 90 Controller which has a precision measuring element. It is equipped with a wide-range sensitivity adjustment, and can be changed from direct to reverse acting, or vice versa, without additional parts. The case is offered for wall and for flush panel mounting. Bulletin No. 444 gives complete information.



"Certified" Flexible Coupling

A rubber spider cushion is used between the coupling halves in the flexible coupling made by the Certified Flexible Couplings, Inc., 122 East 42nd St., New York, N. Y. The lugs on the spider are convex curved and mate with concave curved surfaces in the lugs on the two coupling halves. Thus uniform compression on the insert is maintained even though the coupling is operating under misalignment.

The oil-resistent rubber insert provides torsional resilience, flexibility and quiet operation, as well as shock and vibration absorption and insulation. No lubrication is required and there is no flywheel effect because of the small outside diameter. The shaft sizes are ½, ¾ and 1 in. for drives of ⅓ to 5 hp.



The Round Table

YES, YES!

Ed sat quietly in the shop office until Al had finished giving instructions to his foreman.

"I see, Al," he said, "that you like to be yessed like any other executive."

"What do you mean, Ed?"

"I was just listening to you talk with your foreman. It sounded like a monologue—you did all the talking; all he said was 'yes.'"

"There wasn't any call for him to say anything else. I was simply telling him how to assemble that new design compressor, and he wanted to show that he understood."

"But suppose, Al, that he had ideas of his own on how to put the compressor together. Something that even you hadn't thought of."

"I'd certainly want to know about it. What do you think I am—one of those stuffed shirts who thinks he knows everything? I don't want any yes men around me."

"That's what all the brass hats say—they don't want any yes men. But if some one suggests something new they can't take it, especially if the man is an old-timer in their shop."

"What difference does that make, Ed?"

"Plenty. Now don't take this personally, Al. You came up through the shop and know what it's all about. But the trouble with most men in high positions, like presidents and managers, is that they don't know the game of detail. They're good spokesmen or advertisers without the practical experience to back it up. They think the shop's a mystery and go outside to find the miracle man who'll unravel it."

"Ed, what you're talking about applies to a few misfits who've worked their way into a place where they don't belong. The big majority of plant executives are not like that. Most of them welcome having their men express opinions as long as they don't try to dictate."

"I don't mean just a few. I'm talking about managers in general—practically without exception. Some are worse than others, of course. But when a man becomes a manager he thinks he's good—far superior in judgment and knowledge to anyone else—his opinion offhand is the best. It's human nature, Al, and you can't get around it."

"You're all wrong, Ed. I've heard lots of big men, or rather men in big positions, say they invite suggestions and even criticisms from their force."

"They say that, Al, and some of them try to believe it, but they don't really mean it. I've seen them start out in a new plant with a little talk on

how they want to use the experience of everybody in the outfit. They're going to change this and correct that, and hope everybody will help. But down in their hearts they're sure that they know more than the common herd. In about six months all the fine plans for everybody to have his say is forgotten. Things slide back in the same old rut—or worse."

"You're certainly sour on the world today, Ed. I suppose you don't think that there is any such thing as a good shop executive."

"Sure I do, Al, but he's got to know his stuff. Then he can make a good showing even if he won't listen to anyone. But the idea that a brass hat will take advice is a delusion. To them the smartest men in the shop are those who agree with them, and perhaps they're right."

"How's that?" asked Al.

"Because if they're really smart they know that 'yes' is the right answer when talking to their superiors."

Are plant executives open-minded about their assistants' ideas? Or do they only think they are?

DISCUSSION

A Step Down

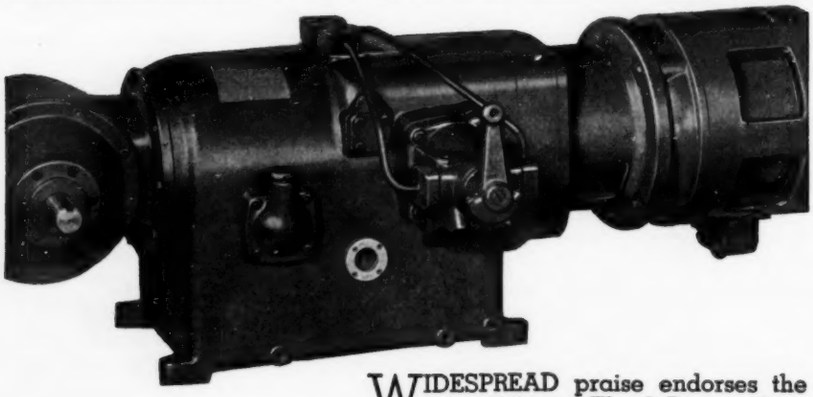
Al has committed one of the most serious blunders in the entire industrial catalog, and he is due to pay for his mistake one way or another. His hasty action in making Brown foreman was bad indeed, but his blunt method of putting him back on the machine is worse. The very least he could have done would be to make a sincere apology to the man. There are countless good mechanics who are not good foremen, and it is not their fault.

Ed's suggestion that Brown be dismissed as a means of putting an end to the mess is even more calculated to cause trouble than the present setting. Ed is breeding a strike there, or some trouble almost as serious. All the elements for a siege of real warfare are present, and Al will have to watch his corners closely. If I were he, the apology would still be made. A belated apology is better than none.

Possibly, if Al will face the issue squarely, make his apology, taking the blame as he should, and tell Brown he is giving him an increase in pay, or some other valuable concession in order to make amends, he can still head off trouble. It will at least give Brown a chance to get the smouldering load off of his chest, for he will have a direct opportunity for whatever comeback he chooses to make. The thing cannot be left under cover with impunity. It must be dealt with and disposed of both promptly and fairly.

—JOHN E. HYLER.

"THE FINEST WE HAVE EVER USED"



WIDESPREAD praise endorses the New Oilgear *Fluid Power* Variable Speed Transmission. Production men say its performance amazes them. It provides hairline accuracy of speed control; steplessly variable speed; even, positive speeds; smooth acceleration and reverse; a complete range of automatic and hand operation. The new simplified design makes Oilgear compact, widely adaptable and low in price. You will want full information about the transmission that is upsetting production figures in many lines. Bulletin 60000 sent free. THE OILGEAR COMPANY, 1309 W. Bruce St., Milwaukee, Wisc.

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- ★ Smaller Size, Lower Cost

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Fluid Power

VARIABLE SPEED TRANSMISSIONS

New Tricks

In the machine shop some ways of doing any job are definitely wrong, but who can say with truth that any particular method is the best? There is always room for improvement and it is part of the foreman's work to effect improvements if he can.

A new foreman should be careful when suggesting improvements. In a shop where initiative is used and honest efforts are made to employ highly efficient methods, several ways of doing a job are frequently tried before it is decided to pursue a definite course. A new man when making a suggestion may only be resurrecting an already tried, but not entirely successful, method.

In a general machine shop employing really good mechanics of all kinds, the foreman cannot be expected to possess knowledge and experience equal to the combined knowledge and experience of all of his men. Therefore, he should be chary about attempting to instruct men in their own class of work. Skilled men develop their own peculiar methods, or perhaps habits, which are not always strictly orthodox, but to attempt to make them alter their methods is as disastrous as insisting upon a left-handed man using his right hand.

—R. HUTCHESON,
Kenton, Middlesex, England.

In this case Al is open to censure by withholding the necessary instructions, seasoned with a little friendly advice, from the new foreman before turning him adrift. No doubt to save "face" the foreman is adopting the best method possible to lose it. In allocating the blame I would place most of it upon Al's shoulders.

Naturally, the foreman's brains should predominate, but success will only be secured when they are used in conjunction with the whole of the gray matter within the department. It is absolutely essential that he govern his actions so as to command cooperation. To attempt in a more or less ruthless manner to force his ideas upon the old hands, will immediately alienate them, and he alone will have to carry the load.

Many years ago when a young machine shop foreman, I managed to get an order through for a new machine tool. Upon its success depended my own reputation and also the introduction of many other new machines. Acting on the advice of a wise old manager, a few casual talks about the machine were undertaken with the intended operator. The result was that

when the machine arrived this operator actually thought he had bought it and all doubts of success were removed.

This policy, which never fails, is applicable to both workmen and foremen, many of whom have been broken in by the writer. It begets the necessary confidence from subordinates and eases the load which all foremen must carry. —F. P. Terry.

Al's new foreman seems to be starting in wrong. It would be a good idea for Al to have a heart-to-heart talk with him and to find out how much he really knows and how much of his method is bluff.

Before offering any new ideas to the men, it might be a help to the new foreman to be a good listener for awhile; to keep his eyes open; and to consult to a certain extent with the older men. In that way he will quickly learn the methods used in the shop and can compare them with his own ideas.

It was a bad move on the new foreman's part to have forced an old employee like Jim Weston to use a certain indicator when Jim, no doubt, had used his own so long that he was used to it and might not be able to do so well with a new one. Instead of antagonizing the older men, it would be better for the new foreman to study new ways to improve the quality of the work and to see that the right men are on the right jobs.

—Hugh M. Mitchell.

It is too much to expect any one man to be able either to perform or direct to the last detail all of the operations in the average general machine shop. It would seem that any well balanced foreman would realize that the men in his charge, who have had considerable experience on the work they are doing, would have attained a certain special knowledge, together with speed, deftness, and accuracy, that he could not reasonably expect to have.

No one can know what latent talent is available in workmen except they be given a chance for expression. The foreman who doesn't take advantage of a workman's ability is comparable to one who fails to make use of the machine tool that is best adapted to the job at hand. —John Mark May.

Praise in Public

Open praise, with private rebuke, is one method of handling men, while outspoken bluntness, either in praise or blame, is another. Either method is legitimate and successful if done spontaneously, but in such matters it is unwise to adopt a rule but rather to obey impulse.

Instead of spurring men on to continued effort, open praise may have the opposite effect on them of developing slackness. It also may engender jealousy or be accepted as a Scottish method of reward.

I appreciate blunt, straightforward men, though occasionally hurtful, rude or bullying. The "John Bull" characteristic is very useful in a workshop, especially when accompanied with a little discretion between callous thick-skinned men and the willing sensitive ones. In conclusion, I would say cultivate the men in a straightforward manner but use impartial discipline.

—William Bryce,
Sheffield, England.

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TRADE PUBLICATIONS

CAST IRON. Some sixteen distinct types are discussed in the "Symposium on Pearlitic Malleable Cast Iron," a publication of 32 pages obtainable from the American Society for Testing Materials, 260 South Broad St., Philadelphia, or through the American Foundrymen's Association, Cleveland, at a price of 60 cents each. The introduction details the scope of the discussion with some historical information, and describes a systematic subdivision of the pearlitic malleables.

CHAIN HOISTS. A small, convenient catalog on hoisting equipment gives briefly the salient points on chain hoists, trolleys and similar equipment manufactured by the Yale & Towne Manufacturing Co., Philadelphia Division, 4530 Tacony St., Philadelphia, Pa.

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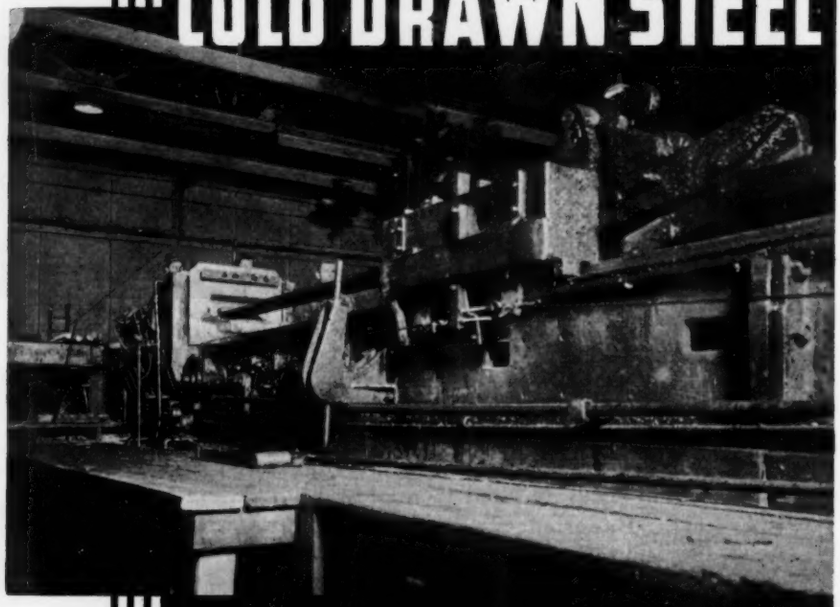

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CONTROLLERS. A folder briefly describing the features of its air-operated controllers, is available from The Brown Instrument Co., Philadelphia, Pa. In particular the folder stresses the simplicity of the recently introduced line of instruments.

CONTROLLERS. Model 90 pneumatic-type controllers for temperature, liquid level, and pressure are discussed in Bulletin No. 44, issued by The Bristol Co., Waterbury, Conn. The principle of operation is carefully presented.

CONVEYOR CHAINS. A 16-p. illustrated book No. 1552 covering a line of "RC" Silverlink conveyor chains operating over cut-tooth sprocket wheels has just been completed by the Link-Belt Co., 519 N. Holmes Ave., Indianapolis. Many styles of attachments are shown. The catalog gives complete dimensions, weights, ultimate strengths, and list prices.

CUT-OFF MACHINES. Four publications issued by the Andrew C. Campbell Division of American Chain Co., Bridgeport, Conn., are as follows: No. DH 949 on the Model 20 dry abrasive cut-off machine; No. DH 848 on the Nos. 202 and 203 wet abrasive cut-off machines to cut practically any material; Bulletin DH 870 on the Model 302 horizontal wet abrasive cutting machine designed primarily for cutting flat stock, and Bulletin DH 790 on the "Hudorkut" submerged cutting machine in which the piece is immersed in coolant, and by which practically any material can be cut.

DISSTON MANUALS. Henry Disston & Sons, Inc., 720 Tacony, Philadelphia, Pa., is again offering six small pamphlets on the selection and care of small tools of its manufacture. These publications concern: (1) "Metal-Cutting Band Saws," (2) "Hacksaw Blades," (3) "Files," (4) "Inserted-Tooth Metal-Cutting Saws," (5) "Solid-Tooth Circular Metal-Cutting Saws," and (6) "Carboloy Products" (saws, knives and tools other than used in the metal-working industry). These booklets give the technical reasons for the selection of the above tools, recommendations for use, and data on application to various machines on the market. Any or all of these pamphlets are available by writing to Disston at the above address.

SPROCKETS. Tabulated in the 24-page book, No. 1557, are the many cut-tooth sprocket wheels now available with "Silverlink" finished-steel roller chains, according to the Link-Belt Co., Indianapolis, Ind. This new book places the Link-Belt roller chain and sprocket business on mail-order basis.